THE IRON TRADE REVIEW

VOLUME XXII. CLEVELAND, O., MARCH 28, 1889. NUMBER 13.

THE IRON TRADE REVIEW.

A JOURNAL OF THE
IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS.
IS PUBLISHED EVERY THURSDAY BY THE
CLEVELAND PRINTING AND PUBLISHING CO.,
Corner St. Clair and Wood Streets, Cleveland, O.

TERMS, (strictly in advance):

One year.....$3 00
Six months.....1 50
Three months.....75

Advertising Rates Furnished on Application.

ENTERED AT THE POSTOFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

CLEVELAND, O., MARCH 28, 1889.

THE WEEK IN IRON CIRCLES.

General Features.

A comprehensive sweep of the trade horizon fails to show very many encouraging features. While in Great Britain, Germany, Austria and Belgium the crude iron markets are firm and prices have an advancing tendency, in this country there is almost directly the opposite state of affairs. If the last monthly statement of the condition of blast furnaces in the United States is to be taken as an indication of the probable outcome for the year, we will have made, when the books are closed next December, 7,750,000 tons of pig iron, or more by 1,250,000 tons than in 1888. Is our consumptive capacity correspondingly increased, or are we piling up pig iron at the rate of over 45,000 tons a month? Certainly none of the indications justify us in arriving at the latter conclusion; and, therefore, we are forced to the conviction that we are consuming at least as much pig iron in 1889 as we did in 1888. Whence comes this demand? At first glance it might be inferred that there has been a decided falling off in the demand for steel rails; yet the returns show that the sales up to March 1, were 630,850 gross tons, an increase of 11½ per cent. over those for the corresponding period of 1888. It must be said, however, that the present condition of the rail market is not particularly encouraging. The sales last week were light, not aggregating over 6,000 tons, East and West. Add to this the fact that quite a number of crude-iron makers, in both Northern and Southern markets, have recently accepted contracts for future delivery at the lowest prices ruling this season, and the gravity of the situation will be apparent. Special advices from leading iron centers are of the same general tenor. At St. Louis there is "little demand, not much iron offered, yet nearly everyone seems hopeful that general business will be good this year." At Chicago, "increasing stocks and diminishing demand give the situation a bluer aspect than is pleasant for iron men to contemplate." The announcement that the new Chicago steel combination will run three of its fourteen furnaces in Illinois and Wisconsin on pig iron for the general market, will not be received with especial pleasure by Southern competitors. The week has been a quiet one at Cincinnati, buying being confined mainly to cover contracts for castings recently taken. Rolling mills report business dull, and as a consequence forge grades are in less request. Our advices from Detroit are to the effect that, while the tonnage of charcoal pig iron has been about the average the past week, the market has not shown as much strength as reports from other sections would seem to justify. Inquiries for round lots have been received, and as they come from widely separated points the indications are that April will meet the expectations of sellers, and a large amount of buying take place. Our correspondent at Louisville writes that there has been a fair demand for iron during the past week. Prices are firm for standard brands, and show a slight increase. A number of irons, however, are being offered at the same prices that have prevailed for some time, but strong mill irons are firm, and buyers are willing to meet the furnace's views, in case quality is assured. The metal market at Pittsburgh has been very quiet during the past week, and prices are hardly so firm as they were earlier in the month. Business is exceedingly dull with the mills, which, of course, exercises a depressing effect on raw materials; but still prices are too low all around to admit of much, if any, further decline.

Iron Ore.

Some very important changes have occurred since our last week's report. Having practically come to an understanding with the vessel interests, and being thoroughly acquainted with the needs and requirements of the furnace business, the ore men have at last quoted prices, and some large sales at the new prices are already on record. The situation was, perhaps, forced a little by the over-anxious attitude of the vesselmen, who, it seems, after making a few Escanaba charters at $1.05, lost all confidence and engaged to carry ore for the entire season, at $1.25 from the head of Lake Superior. The chances are, however, favorable to an advance in charters. The Minnesota Iron Company is reported as disposing of 350,000 tons of Vermilion ore—100,000 for Chicago, and the balance for Lehigh Valley points—at a price equal to $5.75 at this port. A sale of 25,000 tons of Republic ore is reported at the same figure. These were the opening prices for last season, when freights were higher. Strictly Bessemer Gogebic hematites are the strongest on the list, $5.25 being the figure asked, while for Marquette range hematites, non-Bessemer, but not exceeding .10 in phosphorus, $4.25 is the figure. For some ores no price has been made as yet, owing to disagreement as to the cost of lake freight, and the market can by no means be called active as yet. The ore men are in no hurry, preferring to answer inquiries rather than making the rounds of their customers. The news of the failure by the Chicago steel syndicate to secure a large block of ore at prices below the market—exclusively reported in these columns—has since been fully confirmed with this addition that the Chicago people who, two weeks ago, had no use for non-Bessemer at any price, are now anxiously inquiring for that class of ore.

Pig Iron.

Contrary to expectations, the advance that has come to the furnace interests during the past month has not been followed with as good a result as the peculiar conditions of the market would warrant. Plenty of iron is being sold, and it is the consumers who are in quest of the material, but quotations are remaining stationary, and the general advance which was foreshadowed at its inception, was stopped after the first step. Nevertheless, the furnace interests are satisfied with the healthier tone of the market which, if maintained for a little while longer, will materially assist the consumers in deciding upon large orders for long future delivery. That the furnace men full well realize the situation, is apparent from a refusal to sell 2,000 tons of mill iron at a Valley furnace at $13.75, sixty days. There is quite a lively demand for Bessemer iron—a rather scarce article at this time. Mill iron is also a favorite at present, while foundry numbers are a trifle dull. News has been received of a contract between some Michigan parties and a large Southern furnace plant, for a monthly delivery of a quantity of furnace iron at a price equaling $10.60 at the furnace. Still, nobody is much concerned about this inroad of Southern iron, since before being fit for use it requires an admixture of strong lake iron. The furnaces in this vicinity, that have blown out this year, are still out, and the prospect is that they will not go into blast again until the accumulated pig stocks are greatly reduced.

Hardware.

Jobbers report an excellent trade and in some cases are unable to fill their orders. Every line of the business is thriving and no complaint is heard. Tin is a trifle stronger. Nails are held at $2 *loco*, and gas pipe has had an advance, the discounts being 67½ and 55 and 55 and 47½ respectively on black and galvanized.

Merchant Iron.

Bar iron is a trifle firmer at $1.60, and more sales are reported than for some time past. Sheets are also strong at $2.75 for No. 24 out of store. Combination shapes are in good demand, quite a large order of 4″ beams being taken at $2.90.

Scrap Iron.

Mill men and foundry firms are active buyers, and old American rails are sold at $22.50@$23. Wrought scrap of good quality is firm, and the supply is limited. Car wheels bring $19.25.

TURNING A NEW LEAF.

The numerous and perhaps radical changes in the typographical make-up of the IRON TRADE REVIEW, inaugurated in this issue, will be apparent to our friends and need not be dilated upon. We trust they will commend themselves to the good taste of all. A word, only, in regard to the distinguishing features of these various changes. The hasty reader of to-day wants to get at the meat of the news with the least possible hindrance. A sumptuous cover and an imposing array of advertisements as a preface may please a few, but the average man of business hasn't time, in his first glance at his paper, to admire the one or wade through the other. What he wants to know, first and foremost, is: What are the new movements this week in the industrial world? The IRON TRADE REVIEW attempts to meet this demand by putting its distinguishing news features right at the front, without further ceremony. Does the reader want the cream of the iron news of the week? He will find it always on the first page, condensed, classified and comprehensive. Having done justice to this, he is better prepared to look more leisurely over the other matter in the paper, and not least in importance, the advertisements. As heretofore, the IRON TRADE REVIEW will aim to cultivate promptness, accuracy and fulness in its industrial reviews, which have been so widely copied as a regular feature in a score or more of papers in this country and abroad. The really valuable trade papers of to-day find their right to exist in cultivating special fields so assiduously that competition is not attempted, because impossible, from any quarter. With twenty-two years of successful history behind it, with a general recognition of its standing as the special representative of the iron, steel and machinery interests of the "Central West," and with an authenticated *quid pro quo* for its advertising patrons, the IRON TRADE REVIEW bespeaks for itself the kind support of its constituency and a continuation of the generous recognition of its contemporaries.

CUBAN IRON ORE.

Interest in the development of the Cuban iron ore deposits, which was recently re-awakened by the announcement that Messrs. George H. and S. P. Ely, of Cleveland, are about to make extensive investments in that island, will be increased by the statement that there is now being organized in New Jersey the Empire Manganese & Iron Company, with a capital stock of $500,000; W. S. Chamberlain, President; N. J. Botsford, Vice President; James Gilfillan (ex-U. S. Treasurer), Secretary and Treasurer. This company is said to have a number of valuable manganese properties in Cuba, and to have already marketed over 2,000 tons of the product. Two miles of tramway is now being built, and other arrangements are being made for the shipment of large quantities of the ore both to the United States and to Europe. An analysis of two different lots runs as follows:

	Per Cent.		Per Cent.
Silica	4.62	Iron	1.26
Sulphur	.062	Silica	.72
Phosphorus	.002	Phosphorus	.070
Metallic Manganese	60.80	Sulphur	.070
Moisture	2.18	Metallic Manganese	55.61
Iron	.66	Moisture	1.68

Surely, if the above analyses hold out in the general run, the deposit is most valuable, and its development will be awaited with keen interest. Shipments of ore in large quantities are expected to begin in the early part of June.

AN "ALABAMA DISTRICT" IN OHIO.

While the attention of the world has been directed to the marvelous mineral resources of Alabama, and justly so, the important fact seems to have been lost sight of, that there is in Ohio a district remarkably analogous to it in respect to the presence and abundance, in the same hills, of all the raw materials that go into the blast furnace. Reference is had to the extensive deposits of coal, limestone and iron ore in Scioto, Lawrence, Jackson and Gallia counties, in Ohio. Let us take the recorded facts as to the present showing of these three raw materials. Two miles west of Olive Furnace, a little station on the Dayton, Fort Wayne & Chicago Railway, is struck the Waterloo coal region, so-called. Commencing at the foot of the hill and going up, the coal measures appear as follows:

	Feet.
No. 4 Brookville, 20 feet above level of Pine Creek—65 feet below lime rock	4
Limestone—4 a—85 feet above level of Pine Creek	5½
Newcastle No. 5—20 feet above lime and 105 feet above level of Pine Creek	3
Sheridan—45 feet above Newcastle	4½
Hatcher—6 a—85 feet above limestone	3
Waterloo, No. 7—40 feet above Hatcher, or 275 feet above level of Pine Creek	5½
Grand total of coal in hill	25½

What do our Alabama friends say to 25½ feet of coal in the same hill, or rather in a succession of hills extending for miles and miles? If the quality of the coal be questioned, we submit the following analyses of recent date and of unquestioned correctness:

	Moisture.	Volatile Combustible matter.	Fixed Carbon.	Ash.	Sulphur.	Fuel Ratio.
Coal Blossom, Upper Freeport--						
No. 7 Waterloo—						
Chas. Neal	6.44	37.56	49.42	6.58	1.16	1.31
Thos. Cooper	6.98	36.65	50.14	6.23	.57	1.36
Russell Bros.	7.13	35.52	49.64	7.71	.56	1.39
Coal Blossom, Lower Freeport—						
No. 7, a. Hatcher—						
Coal, Mid. Kittanning.						
No. 6, Sheridan—						
Washington Fcae	6.69	38.58	50.61	4.12	.75	1.31
" Top	5.07	33.81	56.48	4.64	.76	
" Middle	6.04	33.76	57.69	2.51	.76	
" Bottom	6.46	32.29	56.73	3.52	.76	
Coal, blossom, Lower Kittanning—						
No. 5, Tunnel or Newcastle	5.19	41.86	47.69	5.26	1.40	1.13
Coal, blossom, Clarion, Upper—						
No. 4, a Limestone						

The Sheridan coal, it is claimed, can be used successfully in smelting iron ore, being, in fact, the peer of Jackson county coal used for the same purpose. But this is not all. Overlying this 5½-foot vein of splendid coal, is a roof of seven feet of ferriferous limestone, and the limestone is capped by three feet of the well known limestone iron ore. This ore has been mined and smelted for years, but as yet only on a small scale. Here are sample analyses of it:

RED ORE (LIMESTONE).

	No. 1.		No. 2.
Metallic iron	51.90	Metallic iron	47.810
Carbonate	5.00	Silicon	7.000
Alumina	1.40	Calcium carbonate	2.200
Silica	3.00	Alumina	.132
Phosphorus	.08	Phosphorus	.980
Sesquioxide	1.60	Sulphur	.097
Sulphur	.40	Carbonate acid (moisture)	21.000

	Red Ore.	Calcined.
Manganese	1.02	1.06
Lime	.04	.42
Silica	2.64	1.43
Sulphur	.02	.02
Phosphorus	.32	.35
Metallic iron	55.88	60.89

A local paper, referring to the above facts, well known to a few geologists but a surprising revelation, no doubt, to the inhabitants of that region, is constrained in the exuberance of its fancy, to paint the following prophetic picture:

Here is your iron ore. Here is your coal for making your iron. All in the same hill. There is no transportation needed here except for the manufactured product. You build your furnace at the foot of the hill You mine your coal, your ore and your limestone above your furnace, and slide it down to the top of your stack, and shovel it in and take out the manufactured product below. We are here to assert that iron can be made as cheaply in these hills as it can be made in Alabama. We have the same conditions here they have there, with this difference, with this distinction, the Hanging Rock iron is worth in the markets of the world, and commands, in cash, from two to two dollars and a half more per ton than does the iron of Alabama.

While not sharing with our contemporary all of its bright visions of the future, we direct attention to this region as having within it vast possibilities for the future, compared with which its past record as an iron-making center will appear insignificant.

NEW ORE-CARRYING ROUTES.

The past two weeks have developed almost one sensation a day in iron ore transportation circles. First and foremost came the announcement of the purchase, by Mr. Andrew Carnegie and associates, of the Valley Railway, thus securing a new through line from Cleveland to Pittsburgh, whereby to transport his iron ore more cheaply from the lake front to the great Pittsburgh mills. If it should turn out that Mr. Carnegie is the real purchaser, we shall expect to see the plucky Scotch-American make his next move in the direction of building or buying a fleet of fast ore-carriers, thus reducing the transportation of his raw material to a minimum. The problem is an enticing one, and Mr. Carnegie is just the man to be entranced by it. At any rate, it may be set down as certain that the Valley Railway has been sold for something like $7,000,000, and that, if Mr. Carnegie has not a finger in the pie, he is at least within hailing distance.

Another report, quite as surprising, is that telegraphed from Erie, Pa., on the 15th inst. It was to the effect that the Baltimore & Ohio Railway had decided to concentrate its lake traffic at Erie from Sandusky and other points, and that an immediate increase in docking facilities would immediately follow. Close upon the heels of this statement comes the news that the Pennsylvania Company is to expend $200,000 at once in bettering its ore-handling appliances at Erie. The same company had already announced its intention of expending a large sum of money in improving its Cleveland docks, and it has recently added very materially to its facilities at Ashtabula.

All in all, the indications point to a very lively season in ore-transportation circles, with some surprises in store when the figures of receipts at Lake Erie ports are made up next December.

BOILER EXPLOSIONS—THE CAUSES AND REMEDIES.

BY A. J. WRIGHT.

WRITTEN FOR THE IRON TRADE REVIEW.

The several recent disastrous boiler explosions, notably those at Hartford, Conn.; Scranton, Reading and Pittsburgh, Pa.; St. Louis, Mo., and Cleveland, O., incurring an average loss of about ten lives, including many women and children, and other people wholly innocent of any responsibility for them, and destroying an average of over $30,000 worth of property, has awakened great interest and anxiety, not only among steam users but also among employes; and, in fact, on part of the public in general. These six appalling explosions all occurred within the short period of four weeks, the first, that at the Park Central Hotel, Hartford, Conn., occurring on February 18th, and the last, that at the West Point Boiler Works, Pittsburgh, on March 14th. There were several other explosions within this period, but they were of such an ordinary nature as to be completely overshadowed by those mentioned, which followed each other in such rapid succession that the uneasiness manifested is but natural.

These explosions were exceptional in many respects beside their magnitude. All of them, except the first, occurred in what may be termed first-class plants, all belonging to large corporations, where the boilers are generally well equipped and everything is supposed to be kept in repair, and where the best regulations prevail, one being in a silk mill, one in a colliery, one in a boiler works, which, by the way, enjoyed an enviable reputation for first-class work, one in a rolling mill, and one in a large flour mill. The newspaper reports which furnish the only data for this article, and are probably not wholly accurate, also show that nearly if not all of these boilers, excepting in the hotel at Hartford, where there was a combination of enough ignorance, carelessness, false economy and negligence to place this average also above the ordinary, were insured, and inspected periodically, as all boilers should be, and in at least two of the cases city inspection also prevails.

Such being the conditions, it is necessary in looking for the cause, to take a liberal, common sense view, laying aside the too common charge of carelessness or negligence which, it must be admitted, would be absurd as applied to a majority of these cases. What then is the cause?

It is, of course, impossible to go into the details of each case in the absence of definite and reliable information, but in such extremities, a general opinion based upon close observation must be interesting, and the fact of its coming from an interested source, can hardly be regarded as prejudicial.

The annual report of the Hartford Steam Boiler Inspection & Insurance Company, for the year 1888, shows that the inspectors of that company in addition to 168 cases of deficiency of water, 54 of which were dangerous, found 1,702 burned plates, 255 of which were also reported dangerous. In other words, the inspectors of this one company found 309 boilers, which were in immediate danger of exploding, no matter how full of water, as a result of the water having been low at some previous time. When in this connection we consider the fact that this is only the report of one company, and, again, that only a small proportion and the best of the boilers in use are insured, and that there were, according to this company's reports, 8,658 other cases of danger found during the year, among the number being 473 dangerous cases of incrustation or scale, 306 cases of broken stays and loose braces, 178 defective settings, 1,588 cases of defective riveting, 417 cases of leakage at the seams, and 2,065 dangerous cases of leakage around tube ends, 238 cases of defective water gauges; 146 cases of overloaded and 176 cases of safety valves defective in construction; 361 cases of defective pressure gauges, and, "God save the mark," 92 boilers without pressure gauges, and several hundred miscellaneous defects —a total of 8,967 cases of defects where there was absolute danger of immediate explosion it must be agreed that the only strange thing about the frequency of boiler explosions is that they are not more frequent.

But to return to the cause. Here were 1,702 burned plates, 255 of which were dangerous, 15,122 cases of "serious leakage around tube ends," "dangerous," 2,065; 4,552 cases of "serious leakage at seams," "dangerous," 417; in addition to 168 cases of "deficiency of water," 54 of which were "dangerous," all of which had weakened and shortened the lives of the boilers. Now, it is not improbable that a large number of these, nearly 20,000 cases of leakage around the tubes and seams were caused by unequal expansion due to low water at some previous time. Is it not a reasonable conclusion, therefore, that the water becomes low much more frequently than is generally supposed, and that it is the indirect cause of many boiler explosions not attributed to it, and that many competent and faithful engineers and firemen suffer, as a result of the ignorance or negligence of their predecessors. A boiler burned and dangerously weakened under one engineer may not explode until after he has been superseded by a most competent and painstaking one, who may be as innocent a sufferer as the many others killed by it, but we read in the columns of even the technical trade journals as well as the dispatches of the Associated Press, that "the cause will probably never be known, as the engineer was killed outright."

Furthermore, we have evidence other than theoretical tending to the same conclusion. The experience of steam users with the safety water columns is that they whistle for low water about once a month, on the average, even where the best help and most perfect regulations prevail. This may be hard for people without experience with reliable safeguards of this kind to believe, but it is a fact which can be easily demonstrated, and to it is largely due the action of many of the large corporations in throwing out the ordinary combination and equipping all their boilers with these appliances, after learning their value through practical experience. It is clear that the water in steam boilers becomes low oftener than most people suppose, likewise that the boiler is weakened more or less every time it becomes low, and there is no room for doubt that it may ultimately give way with plenty of water in it and even without the contributory assistance of ignorance, negligence, or even over-pressure, in which event it is no less the result of low water than if it had occurred when the water was low.

In this conclusion, and the evidence leading to it, may, we believe, be found the true solution of many mysterious boiler explosions.

What then is the remedy?

First, no matter whether your boilers are new or old, get them insured in some company of recognized standing and noted particularly for the thoroughness of its inspection. This means a great deal more than appears on the face of the advice. It means that if the material or workmanship is defective, or in other words, if improperly riveted or insufficiently braced, you will find it out at once, and if the setting is defective or the furnaces out of shape you will be advised and will have to repair the defects before the company will accept the risk. Nor is this all. It means that if the safety valve is overloaded or defective you will know it, or if your boilers have been dangerously burned, blistered, corroded or grooved you will have an urgent opportunity to prevent loss of life and property by repairing them, before you can get the insurance, and that if they are seriously scaled or filled with sediment, that you will have to remove it at once, and then perchance have some patches put on. Perhaps your boilers may be condemned. The Hartford company condemned 426 boilers last year, but in any event the benefits have now only begun. But you can go to bed and sleep at night with the satisfaction of knowing that the boilers are safe and that you have done your duty to yourself, your employees and the public, and at the same time made a good investment, for it also means that so long as you keep your boilers insured the company will, in so far as possible, by periodical and systematic inspections, keep your plant in the condition in which it compels you to put it at the outset.

But how about the low water? The company's inspectors cannot prevent it except in so far as keeping the appliances in working order are concerned. The inspector may find your boiler in first-class condition to-day and the water may get low and weaken it to-night while you sleep. Or the same result may be brought about by the stopping of a pump, by foaming, by leakage, or as a result of carelessness, ignorance, drunkenness, or what not, within the period of one year between inspections, and result in an explosion as disastrous and fatal as any of those which have horrified the country within the past month, before the inspector gets around again.

There is but one sure remedy, and it is a simple one. Put on a safety water column, not some complicated device which is pretty in theory and worse than worthless in practice, or some untried and perhaps inoperative low water detector, or a fusible plug which becomes coated with scale and fails to fuse, but a real safeguard, something simple, which has been tried and proven to be trustworthy by steam users whose judgment can be relied upon. The result will be highly gratifying. You will find a most pleasing result in the effect it will have on your firemen, who will be doubly watchful as a natural result of having this monitor over them. As a result of personal pride you yourself would watch the water closer with than without these safeguards. By and by some accident will happen and you will hear it whistle unexpectedly and on investigation you will find that no one was directly blamable for the water becoming low, and will see that the little whistle brought brains to the rescue. You will sooner or later hear of its attracting the watchman's attention at night in ample time to obviate any serious results, and when you begin to get acquainted with the appliance and investigate its workings you will discover that it has saved its cost in full by keeping the water at the proper level, and at the end of the year you will find a very small item opposite the "repairs to boilers" in the expense account. These are not imaginary figures, they are actual experiences.

Both the insurance and the safety water columns have a like effect on the employes, which is of the utmost importance. They make those who might otherwise be careless or indifferent, watchful and careful, for any negligence is sure to be reported to the proprietor either by the inspector or the whistle. This extra watchfulness is of itself of vast importance and will go a long way toward preventing "mysterious explosions."

Bad on Armored Ships.

Discussing the question, "Will the War Ships of the Future be Armored?" the *Engineering and Mining Journal* says: Now the great ironc-lads of to-day correspond to the knights of old; they are becoming more and more unwieldy; they are expensive to build, equip and maintain; the great weight of armor deducts so much from their offensive power, and coal and machinery space; and it is extremely doubtful whether they can face modern guns of comparatively low power with success. The whole subject will remain undecided until an important naval war settles it by actual experiment. Since the Huascar fight, the bombardment of Alexandria, and the Glatton trials, there has been little added to our knowledge of the relative progress of guns and armor. Tests of armor-plate may show the resistance of a given weight and quality of metal to actual penetration or breaking up by guns of different powers; but these targets do not really represent the section of an armored vessel's side. A ship cannot be buttressed with masonry and timber bulkheads as are the targets usually set up. It is quite possible that a square blow from a projectile utterly incapable of piercing the armor might bodily crush in the framework, or by merely detaching plates produce fatal results. A ship's side can not have the resisting power of a turret or barbette parapet without increasing the weight of framing, armor and backing to an enormous extent. It is evident that small vessels cannot, by means of armor, be constructed so as to resist fire and, at the same time, have any great offensive force, speed, or coal endurance. Thus in the later progress of European navies, in order to secure a fair average of each of the factors which go to make up a war ship, the tendency has necessarily been to an immense increase in size and cost. Now the question arises: Is a $5,000,000 ship more effective than two of $2,500,000, or perhaps even five of $1,000,000 each, or to use a homely saying, is it better to put so many eggs in one basket?

NO DRINKER of intoxicants can become a member of the National Association of Marine Engineers.

LAKE SHIPBUILDING.

DULUTH HERALD.

There is building by the Detroit dry dock company for Eddy Brothers, Saginaw, a steamship 279.9 ft. keel, 299 ft. over all, 41.10 ft. beam, 23 ft. moulded depth. She will have a triple engine 20, 32, 54 by 42 in., Scotch type boilers 11x12 ft., 160 lbs. steam. She will be launched next month. At the same company's yard at Springwells a steamship is well under way for R. P. Fitzgerald & Co., Milwaukee. She is 264.4 ft. keel, 280 ft. over all, 40 ft. beam, 23 ft. hold. She will have a compound engine 28, 52 by 40, and two marine boilers 9.6 ft. by 13 ft. She will be launched in about two weeks. At the Wyandotte yard of the same company the new composite steamship Manchester will soon be launched. It is for the Inter-Ocean Steamship Company. Her dimensions are 280 ft. keel, 299 ft. over all, 42 ft. beam, 22.6 ft. hold. She will have a triple engine 20, 32, 54 by 42, and two boilers of Scotch type, 11.6 by 12 ft., each, to be launched in ten days. They are building for the owners of the Palmer, a sister ship and of the same dimensions as the Palmer, of steel and wood. She will have a triple engine 20½, 33, 55, by 42, by the Frontier Iron Works, and boilers 11.6 ft. by 12. Also a steel ship for the Cadilac Co., of the same hull as the Manchester, with a triple engine 21, 33, 56 by 42.

Polson Iron Works, Owen Sound, are building a C. P. R. steamship to replace the Algoma. This is the first steel steamer ever built in Canada, and is 30 ft. larger than the Athabasca and Alberta. The works at Owen Sound cover eight acres, and over 300 men are employed night and day. The boat is 305 ft. long, 38 ft. beam, 14.3 ft. hold, with two decks, between decks 8 ft. A saloon cabin runs her whole length, with promenade deck on top. She will have 64 staterooms, and will be lighted with incandescent light, and will be steered by steam. From keel to decks she is built entirely of steel. She is divided into eight water-tight compartments. The benefit which the building of such a boat gives can be imagined when her contract price, $250,000, is remembered.

MARINE RECORD.

John Oades & Son, shipbuilders, Detroit, are building a steamship 213 ft. keel, 228 ft. over all, 36 ft. beam, 14 ft. hold; her frames are all up. She is molded on the floor with 6 inch flitch 18 inches deep, bilges 14 inches with extra cross floors between, and extra futtocks. The outside plank will be garboard 6 inches, bottom 4½ inches, bilges 5 inches. She is being built of very fine timber and will be diagonally iron strapped, and will be as strong as good timber and iron can make her. See will carry about 1,500 gross tons, or about 1,000,000 feet of lumber.

It is gratifying to learn that the volume of trade has increased sufficiently to admit of a Fairbanks testing machine being erected for the purpose of testing iron and steel coupons used in the construction of boilers, &c. Formerly it has been necessary for our local inspectors to forward on to Buffalo, N. Y. any coupons that required testing, and there was consequently a delay before work could be carried on. The new machine will facilitate the building of machinery in the city, and enable the local inspectors to grant a certificate without loss of time. The machine has been erected in the basement of their offices.

The River Machine & Boiler Works, River street, have just completed the repairs to the boiler on the Jim Sheriffs and Egyptian at Ashtabula, and repairs on the Wocoken, tug Dennis Crowley, and tug L. P. Smith. They are now putting new deck engines and pumps on the Oscar Townsend in Toledo, a new pump on the tug John Gregory, and a general overhauling to the Christie Castle, besides which they are putting a new crank shaft on the Maggie Sanborn. The River Machine & Boiler Works are going into the general supply business for steamboats and vessels, including steam fitting.

Captain James Davidson has five new vessels on the stocks at West Bay City, Mich. One schooner will carry 85,000 bushels of wheat. She is already under charter to carry iron ore from Escanaba to Ohio ports at $1.10. A new steamer on the stocks has 250 feet keel, and is 1,600 tons burden. She will be out in the latter part of June.

At the shipbuilding yard of James Davidson, West Bay City, Mich., over four hundred men are as busy as beavers in autumn, constructing four large boats now on the stocks in the yards. One large schooner of 2,200 tons burden is completed save the rigging out, painting, etc. She will be launched as soon as the ice will permit.

The Phœnix Iron Works (Port Huron, Mich.) are full of work compounding the engine of the steambarge, S. C. Clark, also the engine of the steambarge Westford, and supplying her with a new bed plate, and new boiler 8½ diameter, 14 feet long. Compounding the engine of the tug Admiral Porter, and doing general repairs on her machinery and boiler. Building steeple compound engine 12 and 21x16, and boilers 6x10 for the steamer, formerly the E. M. Foster, being rebuilt at R. Holland's ship yard, Marine City. Building a fore and aft compound engine 25 and 50x40, and boiler 11 feet 4 inches by 16, for Curtis & Brainard's new steambarge, building at Marine City, and doing general repairs on the engines and boilers of the steamers C. H. Green, Tempest, Dean Richmond, Fred. McBrier, Geo. L. Colwell and Miame.

The first of the steamers being built at the Cleveland Shipbuilding Company's yard will probably be launched on Saturday, the 23d inst., and will be named Frontenac. She will be commanded by Captain Murphy. She has been built for the Cleveland Iron Mining Company, and is a masterpiece of steel shipbuilding. Her sister ship the Pontiac is well along, and gives evidence of more secret beauty. The Pontiac will go out under command of Captain James Lowe.

The Bradley & Grover steamer, building at Radcliffe's yard, is well advanced, and will be launched in about five weeks. According to the contract she is to be ready for business May 1. Her boilers have arrived here from Erie, Pa., and her engines are fore and aft compound, built by the Cleveland Shipbuilding Company; her dimensions are 250 feet keel, 268 feet over all, 40 feet beam, and 21 feet depth of hold. Her fine elliptic stern looks handsome, and she will be as strong as wood and iron can make her.

BAD NEWS FROM GAS FIELDS.

OHIO VALLEY MANUFACTURER.

It is reported, so says a contemporary, that is careful what it publishes, that the glass manufacturers, in the natural gas regions of Ohio, are on the verge of a general shut down, which will throw 5,000 workmen out of employment. This state of affairs has been brought about to a great extent by overproduction through the many new factories started in the natural gas territory, and partially, it may be parenthetically asserted, by the unsatisfactory conditions of the natural gas supplies.

A number of factories have already taken this step, notably the glass house at Maumee, O.; one at Dunkirk, Ind.; another at North Marion, Ind.; and the four window glass companies at Findlay, O., will do likewise as soon as stock enough to fill outstanding orders is made. The flint glass and bottle factories are in about as bad a condition. In the Western district of the Window Glass Association there are 1,200 pots, 250 of which are already idle, and before the 15th of April not less than 800 pots will be cold and the hands tramping the streets.

In the same connection it may be remarked that for some weeks it was reported that arrangements were in progress for conveying natural gas to Chicago from the Indiana fields, a distance of about 150 miles, but of late these reports,while still appearing in a desultory sort of way,seem to lack grit and fervor. It is now said a syndicate has been formed for the purpose of conveying natural gas to Detroit, the source of supply being the famous well recently discovered at Kingsville, Ont. These reports are interesting in the face of a report recently submitted to the city council of Dayton, O., on the subject of gas supply there. The committee said that the supply of natural gas to Toledo is so unsatisfactory that it is probable the city will soon undertake the construction of a plant for the manufacture of artificial fuel gas. To the majority of consumers the present cost is not less than that of coal under the old arrangement, and the pressure is often so much reduced that the flow is insufficient to meet the wants of the users, while sometimes the supply is cut off entirely. Some of the manufacturers are preparing to return to the use of other fuel in case the city does not soon undertake to furnish a remedy, as they say they cannot and will not submit much longer to the annoyance and extortion to which they are now subjected.

And on last Monday evening in a talk Andrew Carnegie gave at the Franklin Institute Hall, in Philadelphia, he remarked, that he "was sorry he could not take a sanguine view of gas production, but the pressure was largely on the decrease."

It may be added that a large manufacturing firm at East Liverpool, O., Knowles, Taylor and Knowles, who have been using natural gas for some time past, have closed a contract for the erection of a plant which will make about twice as much fuel gas per day as does the one in successful operation at the Disston saw works in Tacony. It is evident from all this that practical men have made immense progress in the last few years in the investigation of processes for manufacturing fuel gas cheaply enough to compete with the natural product, and that they have satisfied many consumers of the fact.

In view of all these reports and remarks, may it not be well for some who are said to be hunting for better advantages in the way of fuel, to pause and wait yet a little while longer, for it is much more than probable that some new fuel-producing process, or improvements on some already in use, will be developed that will equalize conditions and will set at naught many now existing advantages of location, which are very rapidly proving ephemeral. And the new material will have this great advantage—that while the supply of natural gas cannot be depended upon as more than evanescent, that of the artificial product will go on for many years in the future, if not forever.

Steel Water Pipes.

Some time ago Messrs. A. & J. Stewart, of Glasgow, and the Steel Company, of Scotland, in conjunction, supplied tubes of steel for carrying the water over the Tay bridge, this being the first illustration of their use in Great Britain. These pipes were welded by Messrs. Stewart, and were fitted with Riley's patent socket, and completed by the Steel Company. They have proved very satisfactory. Tenders have been put in recently for 1,600 tons of steel water mains of large size for the Sidney water works. Estimates and tenders have been made within the last year or two for several very large quantities, requiring from 100,000 to 150,000 tons of steel; but as was the case on the introduction of steel for ship construction, the progress is very slow. A contract has recently been made with one of the steel companies in Scotland for twenty miles of water main for Mexico, the sheets for which are not more than 1-10 of an inch in thickness. The fear of corrosion is not shared in by the engineers of this scheme, for, having had experience for a number of years of the behavior of wrought iron for this purpose, they have had no hesitation in adopting the stronger and better metal, steel. This main for Mexico is riveted—for such thin sheets cannot well be welded—and the connections are the same as those used in the Tay bridge pipe.

To Make Holes in Steel.

"Sometimes I have had to make holes in steel that was too hard to cut or file easily. Then I make a mixture that will cut a hole. I mix one ounce of sulphate of copper, quarter of an ounce of alum, half a teaspoonful of powdered salt, a gill of vinegar, and twenty drops of nitric acid. This will make the hole, or if it is washed off quickly it willl give a beautiful frosted appearance to the metal."

"THE Building of an 'Ocean Greyhound,'" by William H. Rideing, in April *Scribner's*, describes picturesquely and effectively the marvelous industry of the great Clyde ship-yards, where the swiftest trans-Atlantic steamers are made. The illustrations show the *City of New York* and other vessels in various stages of the process of building.

INDUSTRIAL SUMMARY.

New Enterprises:—

IRON AND STEEL.—Incorporated: New Castle (Pa.) Steel Co., capital $150,000; Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, capital $150,000; Phœnix Iron Works, Meadville, Pa., capital $200,000 .....W. R. K. Sandford is interested in starting a boiler plate and sheet iron works at Selma, Ala.....A large cast iron pipe foundry will be established in Minneapolis. It is proposed to organize the company with a capital of $350,000 to $400,000.....The South Birmingham Coal and Coke Company have been organized at Salem, Roanoke County, Va., with a capital of $1,000,000. Chas. G. Emery, of New York, is one of the directors. The company will erect 100 coke ovens and a furnace at once .....A company has been organized in Philadelphia to operate the Gem Furnace, at Mines Station, on the Shenandoah Valley Railroad, which was sold out by the sheriff a few weeks ago. It was bought in by D. W. Flicker, Superintendent of the railroad company, acting for Philadelphia capitalists, who are now forming the company.

MACHINERY.—The citizens of Beloit, Wis., have subscribed $10,000 and ten acres of land to the Williams Engine Company if it will locate there.....N. S. Sherman will start a new foundry and machine shop at Jackson, Tenn. Machine shop, 40x80 ft.; boiler and engine house, 30x30 ft., and foundry 40x30 ft. .....The Crane Machine Company, of Baltimore, recently chartered with a capital stock of $500,000 by T. R. Crane, of Heathville, Va.; J. Wilcox Brown, of Baltimore, and others, to manufacture agricultural implements, contemplate building works.

MISCELLANEOUS.—The Moffat Manufacturing Company is being organized to manufacture agricultural machinery at Chester, South Carolina. They will have a capital stock of not less than $30,000.....A company is being formed in Wheeling, W. Va., to be known as the Lead-Coated Nail Manufacturing Company. The lead coating is a substitute for galvanizing.....The Commercial Lock Company, to manufacture locks, has been organized at Portland, Me., with a capital stock of $25,000; par value shares, $10; President, Wm. J. Henry, Portland; Treasurer, Herbert C. Briggs, Portland.....In addition to the many corporations of which Mr. George Westinghouse, Jr., is the president and the leading spirit, another company has been started by him, to be known as the Ore Reduction Company, of Pittsburgh. Mr. Lemuel T. Bannister, of the Fuel Gas and Electric Engineering Company, and Mr. Samuel T. Wellman are the officers of the concern. The capital stock of the company amounts to $30,000.....The works of the Novelty Steel Wheel Company will be located at Bissell and will be 50x200 ft., two stories high, iron clad. The following officers were elected at a recent meeting of the company: President, W. W. Acheson, of Pittsburgh; Vice President, William O'Bryon, of McKeesport; Secretary, Joseph Painter, of Kittanning; Treasurer, James L. D. Long, of McKeesport; Superintendent, George McGeorge, of Washington.....Capitalists of Youngstown, Ohio, have about concluded arrangements for the building of an extensive bridge works in the suburbs of Hazelton, on or near the site of the Morse Bridge Works, which were destroyed by fire. The organization will be known as the Youngstown Bridge Company, with a capital stock of $100,000, all of which has been subscribed. Application has been made for a charter, the incorporators being B. F. Boyd, Hamilton Harris, Robert Hunter, L. E. Cochran and John Neilson. The company expect to be in operation in three months and employ 100 men.

Enlargements, Additions, etc.:—

IRON AND STEEL.—The Ajax Forge Company, of Chicago, has increased its capital stock to the amount of $150,000.....The Mary Pratt Furnace, at Birmingham, which is being repaired, will have its capacity increased.....The Scottdale Iron & Steel Company has begun the erection of a new sheet mill. The plant will employ some fifty men.....Some extensive improvements will soon be commenced at the Edgar Thomson Steel Works, of Carnegie Brothers & Co., Limited, at Braddock, Pa. A new 10-ton converter will be put in, in addition to those already in use. A telegraph machine will be put up to transfer the ingots from the converting department to the blooming mill..... It is reported that the Pottstown Iron Company, of Pottstown, Pa., have decided to have their blast furnace rebuilt this Spring, and that the contract has already been given out. The contract consists of four hot stoves, 19 feet in diameter and 65 feet high, blast-pipe, receivers, and a stack 14 feet in diameter by 154 feet high.

MACHINERY.—James Hunter & Son, North Adams, Mass., will make extensive additions to their foundry and machine shop.....The Chattanooga Tool Works are increasing the capacity of their works by 300 per cent. the improvement being imperatively demanded by a heavy run of orders.....D. Giles & Co., the Chattanooga foundry and pipe works, are building an addition to their works at a cost of $10,000, and will increase the capacity of the works one-third. It will add a half hundred workmen to the working force.—[The Tradesman.....The Iowa Barb Wire Company, of Allentown, which now employs two hundred and fifty hands, is about to build a Garrett mill for rolling rods for 4-inch steel billets. The new mill will be 160x210 feet, with a capacity to roll from 30,000 to 40,000 tons of rods per year.....The Bryant Wire Nail Co., of Lynn, Mass., contemplate removing their business to Brunswick, where they have been looking over the ground, and are much pleased with the advantages of the place. They say that their patent wire-nail machine will turn out a much larger product a day than any other, and intend building a new factory somewhere that will enable them to enlarge their business.

Fires and Accidents:

About seventy-five hands are thrown out of employment by the burning of the rolling mills at Portland, N. B., owned by Harris & Co., car builders and founders.....On the 14th inst, a boiler explosion occurred at the West Point Boiler Works of R. Monroe & Sons, corner of Twenty-third and Smallman streets, Pittsburgh, by which six men lost their lives, and twelve others were badly injured.....The Moran Bolt & Nut Works, in St. Louis, were destroyed by fire on the 13th inst. The stock was valued at $30,000, and was totally destroyed. The machinery was valued at $25,000 and will be damaged to the extent of $20,000. Mr. Moran places the damages to the buildings at $10,000.

Failures, Shut-downs and Labor Troubles:—

The nail factory at Mingo, O., is shut down for an indefinite period..... On account of lack of orders the Somersworth Machine Company, Dover, N. H., has shut down.....It is reported that Irondale Furnace, Preston County, W, Va., will blow out about April 1, and will remain closed for an indefinite period. The cause is said to be a want of ore, the new mines opened by the company having proved unsatisfactory.....The failure was announced, last week, of the Lewisburg Nail Works, at Lewisburg, Pa. The company was organized about three years ago as a stock company, but about a year ago was reorganized as an incorporated company with a capital stock of $50,000. There is also a mortgage of $35,000 on the plant. The works were shut down. It is probable that the affairs of the old concern will be wound up and that a new company will be formed.....On Monday, the 18th inst., a ten per cent. reduction in the wages of the employes of the Catasauqua Mfg. Company, of Catasauqua, Pa., went into effect. The reduction affected about 600 hands.....The puddlers of the Blandon Rolling Mill Company, at Blandon, Pa., have accepted a reduction in wages from $3.50 to $3.25 per ton. The wages of all other employes have been reduced in proportion.....Following in the wake of iron manufacturers of the Schuylkill Valley and points near Philadelphia, firms throughout Lebanon Valley have reduced their puddlers 25 cents per ton, and other employes in proportion.....The puddlers and helpers at the Centre Iron Works went out last week on a reduction of about 10 per cent. in their wages.

General Industrial Notes:—

The Pennsylvania Tube Works Company, Pittsburgh, has secured the contract to make sixteen miles of 10-inch pipe for the gas line to be laid in Lafayette, Ind.....The Lloyd-Booth Company, Youngstown, O., have now set up in their foundry a 10-inch roll train, which will be shipped in a few days to the New Albany Forge & Rolling Mill Company, New Albany, Ind. They have just delivered a rotary squeezer weighing 51,000 pounds, to the Knoxville Iron Company, Knoxville, Tenn.....At the annual meeting of the Bessemer Steel Rail Association, recently held in Philadelphia, the following officers were elected: President, Joseph Wharton, in place of Samuel M. Felton, deceased; Secretary and Treasurer, Robert F. Kennedy; Managers, Joseph Wharton, Alexander J. Leith, Benjamin G. Clark, J. O. Morse and Robt. F. Kennedy..... It is reported that the North Chicago Rolling Mill Company has joined the Beam Association, so that the only concern not a member of it is the Allentown Rolling Mill Company.....The nail factory of P. L. Kimberly & Co., Limited, at Sharon, Pa., which has been idle for the past three months, was put in operation on Monday, the 11th inst. The factory contains 40 nail machines.....We are in receipt of the catalogue of the Westcott Chuck Co., Oneida, N. Y. The specialties of this company comprise two styles of chill chucks—the Little Giant Improved and the Oneida—and five styles of lathe chucks—scroll combination (ten sizes), geared (eight sizes), plain universal (eight sizes), independent (seven sizes), and cutting off (seven sizes). One feature of these chucks is that the jaws are reversible.

Personal Notes:—

Mr. Francis B. Allen, Second Vice-President of the Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn., favored the IRON TRADE REVIEW with a call the past week.....S. S. Hartranft, a son of ex-Governor Hartranft, of Pennsylvania, has been placed in charge of the blast furnaces of Brown, Bonnell & Co., at Youngstown, O. Mr. Hartranft was recently furnace manager for the Brier Hill Iron & Coal Company, also at Youngstown.....Mr. J. C. Holt, Secretary and Treasurer of the Antrim Iron Co., Grand Rapids, Mich., informs us that his company has decided to handle its Western trade hereafter from the Grand Rapids office, dispensing with the services of Mr. H. R. Durkee, of Chicago, who has heretofore looked after its interests in that territory. Mr. Holt states that the company's furnace at Marcelona, Mich., is running successfully, making about sixty tons of iron per day of Superior charcoal pig iron. .....Mr. J. F. Holloway, formerly President of the Cuyahoga Steam Furnace Co., Cleveland, now of the Worthington steam pump works, New York, was shaking hands among Cleveland friends on Monday of this week.

CLOTHING A SHIP IN STEEL.

Two or three months or less after the completion of the "fairing," the ship is probably "in frame," and looks like the skeleton of some Brobdignagian monster that has stranded on the bank of the river. The ribs have been hoisted into position at right angles with the keel, and strung together by "rib-bands," and already there are signs of the coming subdivision by decks and bulkheads of the hollow space within. You can still see through her, however; she is like, to make yet another comparison, a great oblong wicker-basket, the supple willows being represented by the network of steel.

The next step is the clothing of the ribs with plates. As they reach the yard the plates are square and flat, but they are passed through rollers of various kinds, from which they issue in any shape desired—hollowed like a spoon, curved lengthwise or breadthwise or diagonally, as the contour of the ship may call for. A steam or hydraulic plane smoothes them down as though they were of the softest of whitewood; another machine trims the edges as easily as a woman cuts silk with a pair of scissors. Then, suspended by iron chains, they are thrust between the jaws of a punching machine, which has a resemblance to a sinister human face with a flat nose, a long upper lip, and a small chin. The jaws close upon them and bite out, ten at a time, the holes for the rivets by which they are to be fastened to the frame.—[From "The Building of an Ocean Greyhound," by William H. Rideling, in *Scribner's* for April.

EMERY WHEELS AND FILES.

RAILROAD GAZETTE, FEB. 15, 1889.

In the *Railroad Gazette* of May 27, 1887, was published an article on "The Comparative Economic Value of Emery Wheels and Files." This article showed that as a result of many hundreds of trials the maximum cost of grinding off cast iron with a solid emery wheel was 11.6 cents per lb., and the minimum cost 2.4 cents. per lb. The cost of filing off cast iron was stated to be from 35.9 cents to 37 cents per lb. The cost of grinding saw steel was given at 28.9 cents per lb., and of filing saw steel at 206.4 cents per lb.

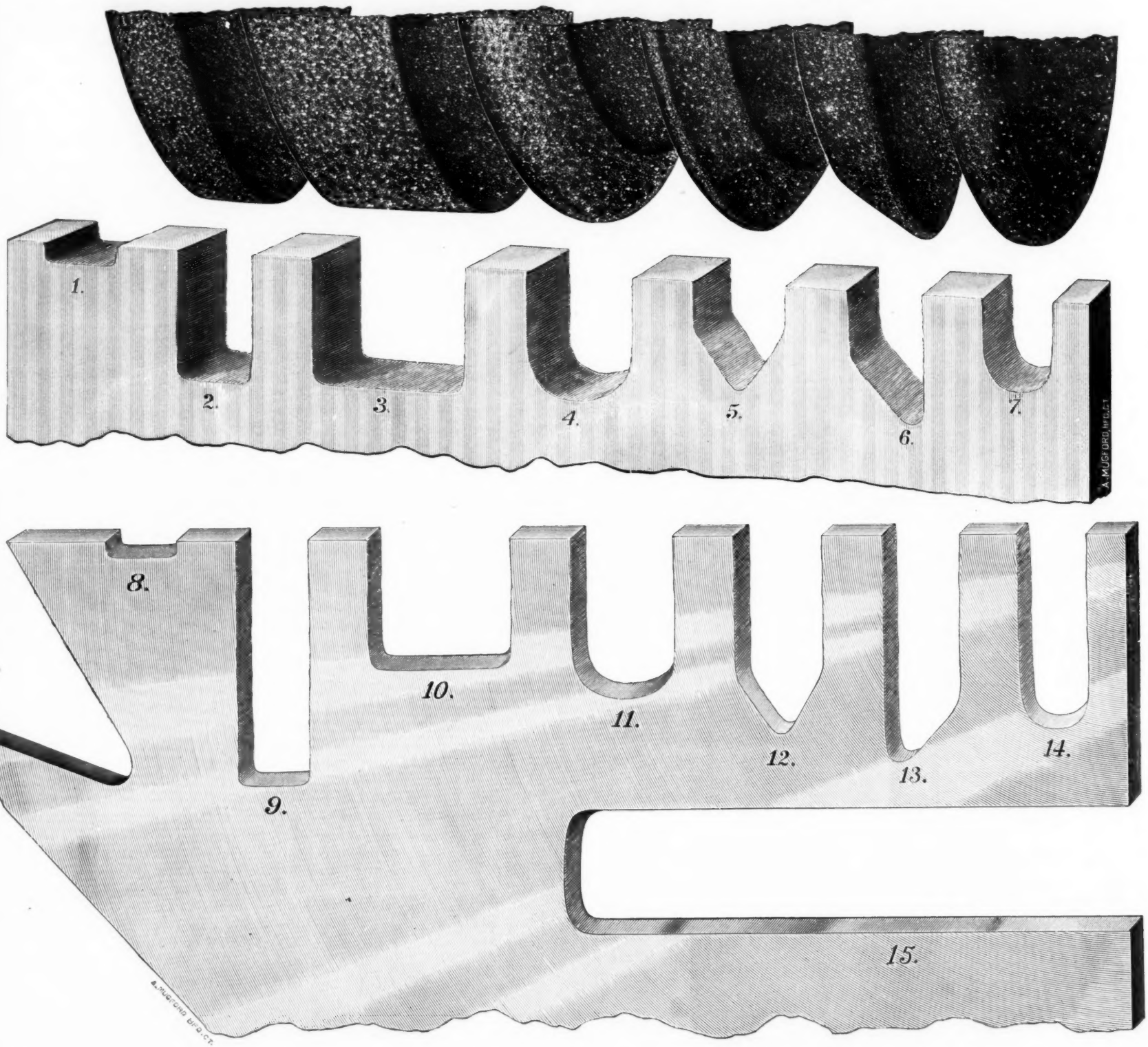
The cost of grinding is modified by the quality of the emery wheel used, and by the conditions under which it is run, and therefore varies often and greatly. A very soft, free cutting emery wheel will grind off metal with great rapidity, but will wear out rapidly. A hard wheel will grind more slowly and wear out more slowly. To get at the cost of product, the price of labor and of wheel must be specially calculated for each case.

A wheel only ½ in. thick, mounted on a small, light and rickety machine, and run by loose, narrow belts, will do but a moderate amount of work. A wheel 3 in. thick, so mounted that it is perfectly centred and runs with so little vibration that wheel and metal to be ground can be kept in continuous contact, and so belted that the wheel maintains undiminished its standard speed, such a wheel will do a large amount of work.

In an article on "Solid Emery Wheels," published April 24, in the *Scientific American Supplement*, No. 538, the greater weight of British emery grinding machines, as compared with American, was indicated, and a strong plea was made that grinding machines should be much heavier and stiffer, in order that greater safety might be insured and the injurious vibration of floors, etc., decreased. The result of numerous experiments, ranging through many years, is to indicate that the use of much heavier machines would lead to an increased product of the wheel, and a greatly lessened cost of work. To get the maximum product from any emery wheel, the metal to be ground must be n *continuous contact* with the wheel. If this is secured, a mile's length of cutting surface passes over the metal in one minute. In countless cases a continuous stream of sparks deludes the workman into the belief that he has continuous contact, while, in fact, owing to the light weight and unsubstantial setting of the machine, a rhythmical vibration has been set up, which leads to discontinuous contact, so that only a part—and sometimes only a very small part—of the wheel comes in contact with the metal.

It is the object of this article to illustrate and to enforce pictorially the enormous disproportion between the product of the emery wheel and the file—the unsubstantial machine and the substantial one. In this case the weight of metal removed was not ascertained, and these tests cannot be closely compared with those given in our preceding article. By themselves, however, they stand as an instructive lesson.

Figs. 2 to 7, both included, show in exact size and shape the cuts made by a set of tanite emery wheels in a cast-iron plate ½ in. thick. Each cut was ground out in 60 seconds. Fig. 1 shows the cut made in same plate in 60 seconds by an expert filer, using an entirely new file with cutting surface of same width as that of wheel which cut slot No. 2, viz., ½ in.



Figs. 9 to 14, both included, show in exact size and shape the cuts made by same set of wheels in a circular saw of No. 9 wire guage, American standard, viz., ⅛ in. scant, or 3 millimetres thick. Each slot was ground out in 60 seconds. No. 8 shows the slot made by a new file in 60 seconds. In the cast-iron plate slots 1 and 2 correctly indicate the comparative work of tools of same width. In the saw steel, 8 and 9 should be compared. As indicated in our previous article, neither filer nor grinder can maintain the one-minute rate of work for any length of time, and it is not possible yet to state in what proportion the rates would decrease or what would be a fair day's average for each. It is proved that the filer's rate decreases much more rapidly than the grinder's. It was *hard work* on the man to file slot No. 8 in 60 seconds, and the teeth of a new file which was used in cutting this one shallow slot were worn dull. As demonstrated by Nos. 8 and 9, the emery wheel did about 16½ times as much as the file.

The emery wheels used in cutting the slots shown in these illustrations

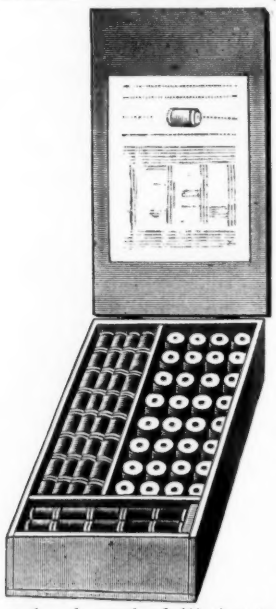
were tanite wheels, class 2. This class is of emery neither very fine nor very coarse, and it is neither the softest nor the hardest of various qualities. It is selected as a compromise or average wheel. These wheels were mounted on a grinding machine weighing only 44½ lbs., the machine standing on an ordinary wooden vise bench, and driven by a 2 in. belt, running so loosely that belt slipped and speed of wheel was variable.

We now call attention to slot No. 15. To grind this out, an old tanite wheel, soft and free cutting, but of unknown class, was picked up in the shop. This wheel was mounted on a machine weighing 662 lbs., standing upon, and bolted into and through, a mass of stone and concrete over 3 ft. deep, and was driven by a 4 in. belt, a tightener pulley being so used as to prevent all slip and to maintain the maximum speed. This slot was cut in *only 30 seconds!* If it were the same width as slot No. 8 it would show that the emery wheel had done 63 times as much work as the file; but as it is $\frac{15}{16}$ in. wide, the work done is actually 126 times as much.

HARDWARE SPECIALTIES.

Spooled Wire.

Malin & Co., Cleveland, O., the well-known manufacturers of spooled wire, have lately introduced an article to the trade which they call "A Retail Stock of Spooled Wire." It is represented in the accompanying illustration. It consists of a box containing 147 spools of wire, the box being tastefully painted, furnished with hinged cover and partitioned off to hold the various sized spools. This enables the retailer to carry a small and well assorted stock of brass, copper and annealed and tinned steel wires, varying in gauge from No. 18 to No. 34. The contents of the case are assorted according to the extensive experience of the manufacturers, who probably are in a better position to judge on this point than retailers who have not handled the goods. It is obvious that the wire thus put up in assorted cases has the well-known advantages possessed by their spooled wire, being easy to handle, not liable to tangle, etc. The outer layer of the wire on the spool is coated with shellac, preventing it from rusting or tarnishing, and all spools containing a quarter-pound or more are stamped with the number of feet on the spool, in addition to the gauge of the wire.



Twist Drills.

Cleveland Twist Drill Company, manufacturers of increase twist drills, self-feeding reamers, taps, cutters, &c., was established in 1874. It claims to make the only drill that has a flute of equal area from point to shank. Every drill inspected carefully after every operation by skillful men. This company is the sole manufacturer of Miller's Patent Self-Feeding Reamers. They

are made with an even number of teeth, but unevenly spaced, and are guaranteed not to chatter. The manufacturers use micrometer calipers throughout their entire factory. Their catalogue includes steel sockets for taper shank drills, taper shank drills, drills with taper or straight shanks, stright shank letter size drills, drills fitting Coe's, Prentice, Worcester or Silver Deming's blacksmith drill presses, square shank ratchet drills, bit stock drills for metal or wood, dowel point drills, bit stock countersinks, tape reamers for drill sockets, straight and taper shank lathe drills, machine or nut taps, pulley taps, fluted chucking reamers, self-centering little giant drill chuck, milling cutters, &c. Some forms of their drills are shown herewith.

FOREIGN COMMENT.

Mining Machinery for China.

An English contemporary says: Many recent occurrences appear to demonstrate that China is at last beginning to move. It is scarcely probable that the change will be other than gradual. In some instances we have managed to get a fair footing in the Chinese markets. According to a recent report from the American consul at Tien-Tsin, the Chinese Government have reopened the silver mines at Jeho, 300 miles northwest of Tien-Tsin. The necessary machines have been bought from the Union Iron Works, San Francisco. The gold mines on the Amoor river have also been reported upon. It does not appear, in this case, whether the machinery is to be British or American.

A Substitute for Steel.

Messrs. H. Ostermann and C. Lacroix have taken out a patent for a new alloy to be used as a substitute for steel in the manufacture of certain parts of watches, such as spiral springs and escapement wheels, which are at present liable to become magnetised. This alloy is composed of from 30 to 40 parts of gold, the same number of parts of palladium, 10 to 20 of copper, and small quantities of rhodium, silver, platina, and manganese. The copper and the manganese are first melted, and the other metals are subsequently added; or all the metals may be placed in a crucible at the same time, the manganese being at the bottom.—[Glasgow Engineer.

Scotch Iron Warrants.

Th *Iron and Steel Trades Journal* (London) does not afford much comfort to the American Pig Iron Storage Warrant Co. in the following comment:

The Scotch market is still in a very large degree the "wet blanket" of the pig iron trade. The stocks in the Clyde have attained enormous proportions. We note that the promoters of the Warrant stores for pig iron in New York propose following the customs which obtain at Glasgow. It is claimed that without huge stocks a steady market is not possible. We rather fear that the most prominent feature of the Glasgow market since the "mountains came forth" on the Clyde has been the almost unbroken depression which has hung over the market. As they never do things by halves on the other side of the Atlantic we may expect to see immense stocks accumulating in the new public stores, and when that happens the iron trade of the United States will not turn out so many Carnegies. The great iron Kings of America who buy up the Highland estates and "nobble the British press," are likely to find it less easy to accumulate millions of dollars when the stocks of iron become as large in New York as they are at Glasgow. The cute Yankees should learn from the experience of the Scotsmen.

Birmingham's Compressed Air Plant.

The Compressed Air Company, Birmingham, is rapidly completing the installation of the service of mains by which it proposes to supply compressed air to users in different portions of the town. Four miles of mains, ranging from 24 in. to 7 in. in diameter, have already been put down, and the other three miles included in the scheme will not be laid down for some time yet. It is hoped that the company may be able to commence operations by the beginning of April. In one case an intending consumer proposes to apply the compressed air to the driving of an 80-horse-power engine for a rolling mill, and generally its application seems likely to be largely applied to the driving of motors of considerable powers. The company has very nearly surmounted the difficulty as to a proper meter. The supply will be per cubic foot, with a pressure of 45 lb. per square inch, and it has been found difficult to obtain an appliance that would neither throttle the supply nor pass air without registering it. Mr. Howard Lane, however, has designed an instrument which it is hoped will efficiently do the work, and which has received the conditional approval of the Corporation authorities.—[Glasgow Engineer.

"Trusts" in England.

Syndicates, or "trusts," as the Americans more discreetly call them, promise to flourish as luxuriantly on English soil as they thrive in Germany—their natural home. The latest development of this craze is said to come from the firebrick trade, which threatens the formation of a "corner." The news will not rejoice the hearts of the British iron manufacturers, who are already sufficiently handicapped in the high prices which they are compelled to pay for the raw material without bearing an additional burden on their overloaded shoulders. The proposed combination will, it is said, embrace the makers of South Staffordshire, East Worcestershire, South Yorkshire and a few other districts. The mode of procedure will be the purchase of the works now standing in the whole of the above wide areas, to be followed by the declaration of a common price list. The scheme is a bold one, as may be judged from the fact that the capital required for the purpose is put down at £3,000,000. As, however, Lord Dudley is mentioned as the chairman of the new firebrick "ring," it is probable that the rumor is, in this instance, substantially correct. Should the scheme be carried out, we may soon look for a considerable advance in the price of iron manufactured in the districts affected. It is doubtful, however, whether the interests of legitimate trade are not injured instead of benefited by these huge combinations, whose success can only be at the expense of the manufacturers.

AMONG THE IRON MINES.

Menominee Range:—

A new find at the Commonwealth continues to improve in appearance and importance, and it now looks as though the well known property is destined to develop into one of the largest mines upon the range. The half a dozen or more pits, each averaging in depth some forty feet, are all bottomed with good ore, and an additional pit, which is now being made, is also in ore. The exploratory work now in progress shows the newly discovered deposit to be at least 350 feet in length and 100 feet in width, the ore lying from twelve to twenty feet below the surface. The probabilities are that the find will be stripped and the ore mined from an open pit. The opening up of such a vast area of new ground will eventually make the Commonwealth one of the largest iron mines in the Lake Superior district.—[Florence (Wis.) Mining News.

S. D. Hollister returned to Crystal Falls on Thursday and was interviewed by a *Mining News* correspondent regarding his property on the west half of the southwest quarter of section 13, 43-32. He announced his intention to begin work at once and vigorously prosecute the development of the mine, and has already arranged for the disposal of all the ore he can mine this season. Though the output will not be large, the necessary work of mining will place the Hollister mine in shape to hold its own with the best of them next year. The mine will be wrought by Mr. Hollister himself, and miners will be put on as fast as room can be made for them.

The Aragon shaft has gone down six feet this week and is now fifty-two feet deep. This makes a foot a day for the past three weeks, and there seems no room to doubt that the ledge (ten feet deeper) will be reached before April 1. The company now employs about sixty men. One of the boilers lately purchased of the Briar Hill company has been bricked in and the other will be ready soon. As soon as the Aragon folks can spare their diamond drill from the east end of their property, some drilling will be done west of town with a hope of striking a westerly continuation of the ore already discovered. Some other parties will do some exploratory work west of the town site.—[Current.

The *Reporter* says that Peter Sheridan, of Fort Howard, arrived at Iron River last week and has already commenced operations at the Sheridan mine, getting the shafts, surface ground and engine house cleared of snow and ice. Mr. Sheridan says that by next week he expects to have a force of 50 men at work; that Supt. Lindsley, of the North-Western, has promised to have a spur put in by the time navigation opens; that Cleveland parties have agreed to take twenty thousand tons of ore and as much more as he can get out. Wm. Morgan will have charge of mining operations, and the prospects are that the Sheridan will achieve a good record this season.

Gogebic Range:—

At the Pilgrim, under the general supervision of Geo. Abeel, and under the direct management of Capt. Sampson, development work is being pushed with vigor. From the bottom of the shaft 208 feet deep a crosscut has been driven southward for the purpose of testing the formation, and ascertaining whether more than one vein of deposit exists. At a distance of about 300 feet from the shaft a 19-foot body of ore was passed through. On this, drifts have been run to the East about 300 feet, and from the west 58 feet. At the end of the west drift is a crosscut of 14 feet. In the main crosscut a dike of "soapstone," about 90 feet in thickness has just been passed through, and the south vein of ore is now thought to be "in sight," though it will require more work to settle this positively. The deposit already partially developed lies about 60 feet to the south of the Milwaukee, Lake Shore & Western track, and a new working shaft will have to be sunk upon it before any shipping will be attempted The mine is quite wet and two No. 9 pumps, a Cameron and a Knowles, are kept constantly going. All the machinery has been put in thorough repair and well-housed, and although only about fifteen men are employed, the work is making good progress.—[Mining News.

The *Pick and Axe* says things are looking very encouraging at the Dangler, formerly the East Anvil. The ore body which was reached at a depth of 140 feet, was followed to the west by drifting about 100 feet, but did not prove of satisfactory width. At this level a crosscut was also run northward 75 feet without developing anything better. Upon sinking the shaft deeper a dike of rock was encountered. This has been cut through, and found to be about 45 feet in thickness. The shaft now, at a depth of 205 feet, is in a mixture of ore and quartzite, carrying fully 50 per cent. of iron and rapidly improving.

A new plant of machinery is to be put in at the Germania mine this Spring, consisting of three 10-foot drums, the same as are going at the Ashland. The foundation is being laid with immense blocks of stone from Marquette. The new shaft at the Germania is now down to the fourth level, 220 feet deep. In places the vein shows a width of 40 feet, and will average 25 throughout. The mine has a great deal more ore in sight than ever before, is looking splendid in all respects, and will put out a very large quantity of ore this season.—[Miner.

About 60,000 tons of ore are now in stock at the Norrie. About 20,000 tons have been shipped by rail during the Winter months.....The Norrie mine is now sending 50 cars of ore daily to the North Chicago Rolling Mills.....The Iron King is now shipping 15 cars per day to the Joliet Steel Works.....The big shaft at the Colby is going down at a rapid pace. A shaft-house, 80 feet in height, is to be erected over it, and various other surface improvements will mark the leaving of the snow.....We understand that quite a force will soon be put on at the Ruby. About 30 men have been employed there during the Winter months. No. 4 shaft is now down about 325 feet, and has passed through the dike of rock and into good ore.—[Iron Spirit.

Vermilion Range (Minnesota):—

This week we looked over the ore dock improvements, and were pleased to observe the progress made since our last report. One hundred men are now engaged, and although the work has been somewhat retarded by the breaking up of ice in the slip, and between the shore and dock the contractors have accomplished more than was expected up to the present time. The last of the pile-driving was done this week, and the crib work is being pushed rapidly ahead. Six carloads of timber for this arrive daily from Tower, although considerable more could be used. The work of doubling the single ore dock is now about complete, and the old part is raised four feet, while on the extension the crib and timber works are being raised rapidly. The oak timber for construction of the pockets is now being shipped in. It is safe to say that the dock improvements will be completed by the opening of navigation, and it is estimated that 900,000 tons of ore will be shipped from here this year.—[Two Harbors Iron Port.

EX-MAYOR HEWITT AND SOUTHERN IRON.

As throwing light on the report sent out this week, that Messrs. Cooper, Hewitt & Co., of New York, are about to move their extensive works to Alabama, we quote as fellows from a recent interview with Ex-Mayor Hewitt, published in the Birmingham (Ala.) *Age-Herald:*

"We have come down to look over your country," he said, "because we have all of us been brought up in the iron business, and of late we have found it was sick. So we started out to discover the cause of the disease, and we soon located it in this part of the country. We have looked at it carefully and found it was not a disease, but a reality, and one that means a stupendous growth in the future. The resources of this region are such—so enormous are the deposits of iron and coal that in time no section can be regarded in competition to make cheap iron, and the South must eventually absorb the trade, or methods of business must be changed. This is true, not so much because you have cheap iron ore and coal, for we have those, but because of the different policy pursued by the railroad companies in the North and in the South. The rates of the Northern carrying companies add so much to the cost of production that, with the great liberality or prodigality of the Southern railroads in carrying mineral products, makes it possible for this section to more than compete with the finer plants and better facilities of the North.

"It is the aim of all firms in the iron business to make their product at a profit, and to do this a market must be established. You have now furnaces enough; the increase of iron for the past ten years has been about 14 per cent., but it will not do to suppose that this ratio of production will be kept up very long, for we are approaching an end to its unlimited consumption."

When asked if it was true that he contemplated the construction of a basic steel plant here, Mr. Hewitt replied: "This is the age of steel, and the industrial tendency is in favor of its production. We are out here to see what you have, and to look over the field just as Mr. Carnegie and others have done. It is then time to make up our minds. The natural habitat of Bessemer steel is in the North and about the lake region, where Nature has placed abundant store of ore necessary to that process. The natural habitat of the basic process is in the South, where you have abundance of material for that method, and here it must be developed. We will keep the acid process North, and the basic process must be South. We will fight you as we did before for a time in the late war, but in the end there will be an end to the strife and all will join hands in the production for this great country."

A Pacific Coast Blast Furnace.

The San Francisco *Chronicle* gives the following account of the blast furnace at Irondale, on Puget Sound, Washington Territory. "About $700,000, most of which has been supplied by San Francisco capitalists, has been expended in an iron smelting plant erected on the shores of Puget Sound. The company engaged in the enterprise has the finest and most powerful engines and machinery to be had for this purpose. It has also a fine town site, including a good water supply and excellent wharfage facilities. The furnace is operated with a hot-air blast, and charcoal is used for fuel. Four grades of iron are made, the finest having brought in the markets a higher price than the best grade of Scotch pig iron sells for. As a proof of its superior quality, the company is now supplying the Southern Pacific Company with iron for the manufacture of car-wheels, and it is well known that car-wheels require the very best iron to be had anywhere. Although the furnace is turning out forty tons of iron a day, it will require several months to complete contracts now running with the railroad company. The location of the works is on the southwestern shore of Port Townsend Bay, and is called by the suggestive title of Irondale. A small town has recently grown up there. The ore is brought from the valley, a mile away, and is roasted thoroughly before being smelted in order to get all the sulphur out of it. A large number of workmen are employed, not only at the works but at the mines, and in transporting ore and limestone, and in the woods cutting cordwood for charcoal. Steel works and a rolling mill will be added to the plant in the near future."

Petroleum for Fuel.

The Brooklyn Elevated and Union Elevated roads of Brooklyn are experimenting with an invention to substitute crude petroleum for fuel, the success or failure of which will soon be determined. The inventor claims that it has always been worked successfully in stationary engines, and can be equally as well utilized on locomotives. The petroleum is stored on the tender, and is fed to the fire from a small jet that throws a continuous spray of the fluid combined with compressed air.

A. T. DOUTHETT, of the Porter Foundry & Machine Company, Allegheny, has issued a call for a convention of boiler manufacturers of Pennsylvania, Ohio, New York, West Virginia, Maryland and New Jersey, to meet at the Hotel Anderson, Pittsburgh, on April 16. An effort is to be made to create a greater interest in the manufacture of boilers, and make the use of the very best material compulsory.

THE CHICAGO STEEL COMBINE.

Circulars to the stockholders of the North Chicago Rolling Mill Company, the Union Steel Company, and the Joliet Steel Company, calling a special meeting for May with a view to their consolidation in one concern, have been issued. Mr. O. W. Potter, president of the first named company, gave some additional particulars about the matter. He said that the consolidation was practically effected; that it had received the assent of the holders of a majority of the stock of all the companies and that the preliminaries were so well forwarded that within two days after the formal vote to consolidate the three concerns would be working as one. He said the Joliet will be bought. In all likelihood the Union will also be bought. The purchaser will not be the North Chicago, but the new concern which is to replace all three. Of course the North Chicago stockholders will be the principal owners of the new concern. $15,000,000 of the capital stock will represent the combined plants of the three companies. $5,000,000 will be in cash as a working capital. $5,000,000 will remain unissued in the hands of the treasurer, to be used in making such changes as occasion may require. The total capital stock will thus be $25,000,000. The issue of stock will be based on a strict valuation of the plants of the companies. It is to be an honest reorganization and is backed by the best men in America.

The plants of the three companies are worth the $15,000,000 when you include all their properties. For instance, the North Chicago has a capital of $6,000,000, but it has accumulated various valuable interests which are not covered by this figure. The North Chicago will surrender its plant on the north branch of the Chicago river, its plant in South Chicago, its plant in Milwaukee and its mines in Dodge county, Wis. The Union and Joliet likewise, in addition to the sale of their plants on the south branch of the Chicago river and at Joliet, will, aided by the North Chicago, put into the control of the new company interests which enable it to command everything from the raw material to the finished product.

"The moving purpose of the proposed combination is economy. It is a self-evident proposition that one management will be cheaper than three. Certain improved conditions in the supply of raw material will also be saved. The main result, however, will be effected by a new departure of a somewhat radical nature. Nothing less than the diversification of the output of the plants. The three concerns as now fixed are adapted almost exclusively to the manufacture of steel rails. Jointly they have a capacity of 3,000 tons a day in this product. Running at full blast every day, they could supply all the steel rails which will be used in the United States this year. Necessarily, since they cannot monopolize the market, they must lie idle most of the time. The seriousness of idleness to the capital interested will be understood when I say that the contingent expenses of a steel plant are twice as heavy when not as when running. Limitations of product to steel rails is, further, a precarious matter owing to the extreme fluctuation in their consumption. Now, it is proposed to obviate this grave danger by multiplying the number of products. There is no reason why it should not make all classes of iron and steel work, now sent here, and over the Northwest generally from Pittsburgh, Wheeling and other points. Iron and steel ships can be built at South Chicago or Milwaukee as well as at Cleveland, Buffalo or Detroit, and I confidently expect the establishment of such an industry at one or the other of the former points as a consequence of the consolidation. The enormous amount of boiler and tank plate now imported to this market may unquestionably be made here. Another result of the consolidation I do not hesitate to predict is the manufacture in Chicago of tinplate."

Discussing the Chicago steel combine, the *Age of Steel* says: The three companies which are about to join their fortunes, presumably, represent the most powerful factors of steel manufacture in the West. Their combined works will rank only second to the great Krupp steel-making establishment; and in the West they will have no competition to speak of in the production of steel rails. True, there are steel works at Cleveland, St. Louis and Pueblo, but the facilities of these are not of vital importance even when they are employed. At present the Cleveland mill is running on structural shapes and agricultural material, and the St. Louis and Pueblo establishments are idle. Possibly, the consolidated company could turn out 800,000 tons of steel rails a year without much trouble, besides 150,000 tons of other steel products. This output, moreover, could be more cheaply secured with the larger capital and improved means of manufacture brought to bear under the consolidation scheme.

Another thing which may have an important bearing in determining the cost of manufacture economyward is the reported connection of members of the proposed combination with Minnesota iron mines, and particularly with those controlled by the Minnesota Iron Company. Ore would certainly be quite an item with the new company, inasmuch as its annual consumption would likely be in excess of 1,000,000 tons.

The New Explosive, Bellite.

A company is being formed in England for the purpose of acquiring and working patents of Bellite, which explosive was invented and patented in Great Britain by Carl Lamm, Esq. Trials have been made in this country, and the only medal at the International Exhibition of 1888, at Copenhagen, was awarded to Bellite as "a safe and powerful explosive." Some of the chief merits claimed are: That it is one of the most powerful explosives known. It presents no danger whatever in manufacture, and can only be made to explode by the aid of a detonating cap, and is therefore absolutely safe. There are no noxious gases given off on explosion, and it can be used in shells. It can be manufactured and used in tropical climates. It requires no thawing in the coldest weather. Mr. C. Napier Hake, F.I.C. (late chief assistant to Dr. Dupre, of the Explosive Department, Home Office), in reporting upon recent public tests, states: "A careful consideration of the experiments leads me to the conclusion that Bellite possesses properties which ought to give it an advanced position among modern explosives." For mining and industrial purposes the acknowledged safety of Bellite, and its great power, are said to be vouched for by some of the best known mining engineers in that country. M. Chalon, of Paris, author of the standard work, *A Treatise on Modern Explosives*, declares Bellite to be safe, powerful, flameless and economical, and the explosive of the future. The production of such high explosives as dynamite and similar nitro-glycerine compounds is said to be not only more costly than Bellite, but also more dangerous. Included in the purchase, the company acquires the benefit of a contract for taking over, as a going concern, the Rotebro Explosive Factory. With the extensions which it is purposed to effect at the Rotebro factory, an output of about 12,000 lb. per week can be made. Numerous enquiries are being received for Bellite, not only from England, but from other countries.

A Hint to American Rail Makers.

LONDON IRON AND STEEL TRADES REVIEW.

In a communication received from one of our Canadian subscribers, this week, he says: "None but British, German or Belgian steel and iron rails are used in Canada. None of these articles are produced at home, nor has there for a considerable number of years been any imported from France. The prices of the United States rails are much too great. The cause of the exclusion of the French rails is said to be that only the best qualities are manufactured in France, as the railway companies there are exceedingly particular and exacting in regard to quality. The Canadians are not so hard to please in that respect, and they accept articles of an inferior description, and such as can be sold by British ironmasters at a very low rate. Although complaints are occasionally heard about such rails breaking after comparatively little use, yet there is but little prospect of any change soon taking place." No doubt our readers will remember the long correspondence we had in our paper about three years' ago upon this subject, alleging shipments of inferior English iron to Canada. As regards Belgian competition in the iron trade in Canada it may be remarked that some time ago strenuous efforts were made by the Belgians to establish metallurgic works in Ontario. Important and extensive orders have also been placed with Belgian houses for iron plates and iron tubings. We think the Belgians are worth watching in the Canadian iron market, as unless this is done we shall in time lose a large number of orders.

A Standard Car Axle.

The proposition for a new standard axle for railroad cars of 60,000 pounds capacity is being agitated by the different railroad clubs of the country. Its necessity is recognized by all, but those interested are divided on the question of size. A standard axle was agreed upon in 1873, but the increase in the weight of car loads has been so great as to render this standard untrustworthy. The sizes for the contemplated axle vary greatly, but many 7 feet 2 inches long and 6 feet 4¾ inches between centers are being used with fair success in carrying heavy cars. Many favor an axle 6 feet 11¾ inches long and 6 feet 3 inches between centres, saying that it is really desirable to retain the latter distance especially in the new standard axle. It is hoped that when the Master Car Builders' Association meets next June the members will adjust all minor differences and hair-splitting distinctions, and agree upon a standard axle which will carry not only 60,000 pounds, but be capable of standing the much heavier strain of a constantly increasing freight business.—[Age of Steel.

A New Method of Commercial Traveling.

Recently in Elbœuf a scheme was started by a number of small manufacturing firms to send out commercial travelers to represent the whole number in given countries. Thus one is to be sent to Japan, and others to other countries. The first syndicate was formed of 20 firms, but others containing smaller numbers have also been formed. As far as possible each member of the syndicate has his own specialty, and the samples of no two members are alike. But even if two firms produce the same wares there is no reason why they should not belong to the same syndicate, inasmuch as the traveler has no reason to press the goods of one more than those of the other, as the commission is the same in each case. A certain amount of confidence must naturally prevail between the members, and any secret compact between the traveler and one of the members would soon be discovered and be injurious to both. The costs are divided between the members, and expenses which would be impossible for one to bear are easily borne by ten or twelve.

Petroleum Solidified for Use as a Fuel.

It is stated that Dr. Kauffmann, a Russian experimenter, has succeeded in solidifying petroleum, to be used as fuel by heating it and mixing it with from one to three per cent. of soap. The latter dissolves the oil, and the liquid, in cooling, forms a compact mass, having the appearance of cement and the consistency of tallow. The product is difficult to inflame, but when lighted burns slowly and without smoke, developing a high temperature, and leaving only two per cent. of a hard black residuum.

Scribner's Magazine for April is notable for the variety of its contents, which include popular articles on railroad affairs, shipbuilding, mountain climbing, and the anatomy of contortionists; literary reminiscences of Scott, De Quincey, Burns, and Dr. John Brown; a paper on Ibsen, the great Norwegian dramatist; and one of the much-praised series of End Papers, the writer for this month being Walter Pater, author of "Marius the Epicurean." The illustrations show equal richness, variety, and interest.

MR. JOSEPH JEFFEERSON has been engaged for a number of years upon his autobiography, which will soon begin to appear in *The Century*. The autobiography will begin in *The Century* during the coming autumn, and the installments will be illustrated with a portrait gallery of distinguished actors.

A 4,300-foot tunnel is being dug at Helena, Mont.

"PIG-IRON" BENNER'S LATEST PROPHECIES.

Samuel Benner, the great financial prophet, in a communication to the *Real Estate Record and Builder's Guide*, published in New York, makes a forecast of the financial and commercial conditions of the country for the coming three years. He reasons from analogy as well as statistics compiled from close observations through many years, and supports his predictions regarding future panics and prices with the philosophic course of reasoning which cannot fail to impress all and convince many. The following is the prophecy in full:

My forecasts at present are not only for the year 1889, but also include 1890 and 1891.

It is a great desideratum to know when good times will commence, and it is also very important to know how long they will continue, and when we may expect the next panic and reaction in general business. The business men of this country do not desire a boom of short duration so much as they do a steady advance in prices and in the developments of trade—continuing for a number of years. However much they may desire this condition for future business, the records of commercial and financial history do not warrant us in making this kind of prophecy.

Since 1825 this country has not experienced a continued advance in the price of iron beyond four years. The resumption of specie payments by the government in 1879 was was the occasion for the boom in business following that event. Now we have a decision by the people that protection will continue to be the policy of the government, making the occasion for the turning of the tide from depression to activity in all business. The depression in trade for 1888 was predicted thirteen years ago, and the prediction was also made at that time that the tide would turn, giving us an era of business activity during the years 1889, 1890 and 1891.

The persistence of the repetition of these trade cycles is becoming a commercial wonder, they ride triumphant over all events which have occurred during the past sixty years to oppose such regularity. These cycles have been verifying themselves through the introduction of railroads, steamboats, the electric telegraph, the suspension of specie payments in 1837 and 1857, the panic of 1873, through the Mexican war, our civil war, through all of our presidential terms from the administration of Jackson up, and up to the present time override and defeat the aims of the present administration, while using the whole machinery of the government for re-election, with the avowed policy of a low tariff, which would depress our industries.

What else can a reasonable person ask to prevent their repetition? Better times and higher prices will prevail for the next three years, and no happening or opposition can prevent them.

The outcome of the Presidential election has laid a broad basis for a general recovery of confidence, an element that has been wanting for the past four years, which we have observed by the many idle furnaces, mills and factories, and the lowest prices for nails, steel rails, and pig iron for a number of years.

The year 1889 opens with cheerful hopes. Our crops during the past year have been abundant; the prospects of an increased foreign demand for our surplus grain and provisions at advanced prices give the farmers renewed energy. We must look forward to a hot and dry Summer this year, as we are not yet beyond the period for a general drought; however, with fair early crops business and prices will show considerable improvement in the Spring months.

We are at the beginning of a prosperous period, and the outlook is for a decided improvement and advance in the prices of iron, railroad stocks, and in all manufactured commodities. Whenever our manufacturers are prosperous, every industrial class is prosperous.

I predict that the price of iron will advance, and the average price for the year 1889 will be higher than the average for 1888; and I also predict that there will be a wonderful advance in prices for iron, stocks, and all products and commodities in the year 1890; all business will be prosperous, it will be a year of good crops and the boom year in this period of activity.

In the beginning of the year 1891 speculation will be at its height—a great business inflation—pig iron $50 per ton in the markets of our country. I predict that there will be a panic in the year 1891. The over-trading and general inflation of business and expansion of credit and confidence will produce this result. The panic probably will be brought about by the effects of the heavy rainfalls and floods, or by the collapse of some large financial business firm. This panic will be a commercial and financial revulsion, and will be followed by a long down-sweep of prices.

IRON FOUNDRIES IN CHINA.

Some time ago, P'au-lut, the Director of the Nanking Arsenal, was commissioned to procure from abroad the requisite machinery for the establishment of a foundry for smelting iron in Kueichow. The machinery, which weighed 1,780 tons, came to Shanghai, in three separate consignments, whence it was forwarded by boat to Nanking. Owing to the rapids and shallows in the river between Ch'ang-te, in Hunan, and its destination, it had to be placed on frames and transhipped piece by piece. The first consignment reached its destination early in August of last year, and the remainder followed closely afterwards. A number of workmen and artisans accompanied it, and arrangements having been made for putting it together and setting it up at once, it was expected that the furnaces would be in working order within a year. The undertaking being on a very large scale, the funds raised by the issue of shares have not yet sufficed to cover the expenditure, and the Governor has been asked to take steps to meet the urgent demand which exists for more money. Kueichow, the Governor explains, is an extremely poor province, and its only natural production is iron. Accordingly, permission was obtained from the Throne for sending officers abroad to procure machinery for establishing a smelting furnace in the Ch'ing district, within the prefecture of Chen-yuan, and thus develop the only resource the province possesses. The great difficulty of inaugurating such an enterprise, says the *Indian Engineer*, is shown by the fact that two years have elapsed before the machinery could be procured from abroad. It has now, however, arrived, and been put up, and the greatest part of the difficulty is over; the quality of the coal and iron obtained in the district is excellent, and the seams in the hills are exceedingly rich. The only drawback experienced has been the difficulty of raising the money at once by shares, which is, no doubt, due to the fact that the mercantile classes have suffered severely in the past from the insecurity attaching to scrip issued by similar companies, and will not be enthusiastic in subscribing to the present undertaking until they see the furnaces actually at work, and the iron turned out. The purchase of the machinery, the erection of the buildings, and other expenses have hitherto been defrayed by loans contracted from merchants, or, by temporary appropriation, from the *likin* revenue, to be repaid on the receipt of the money from the shares, which, it is expected, will shortly be forthcoming, now that there is every prospect of the foundries being brought into operation.

Andrew Carnegie and "The South."

In the current number of the Baltimore *Manufacturers' Record*, Mr. Carnegie states that "upon the much disputed question of the cost of pig iron production in Alabama, $10 a ton for foundry, which is the highest grade, is a liberal estimate. With good management, and for a series of years, some of the best located and best managed furnaces may be able to do even better than this figure. The ability to manufacture at this price must give the Southern manufacturers a large market for their pig. When the next stage comes, and they seek to manufacture the pig into more advanced forms, I believe it will be done by converting pig into steel by means of Bessemer and open-hearth basic processes, and I advised our Southern friends, when there, to make some experiments looking to this desirable end." In closing this letter, Mr. Carnegie says that he regards the South as Pennsylvania's most formidable industrial enemy in the future.

Italian Imports of Pig Iron.

We have received statistics relating to the importation of pig iron into Italy, for the years 1887 and 1888. It appears that the imports from Austria-Hungary during each of these years were 25,442 and 2,117 tons, from France 6,310 and 665 tons, from Germany 26,146 and 356 tons, from Great Britain 68,631 and 33,625, and from Spain and other countries 105,018 and 52,799 tons, the total imports in 1887 being 231,547 metrical tons, and in 1888 89,563 metrical tons. It must be borne in mind that the imports in 1887 were exceptionally heavy, as consumers were stocking iron in anticipation of a duty being levied at the rate of 10 Italian lire per metrical ton. This duty was applied on March 1st, 1888. Taken the statistics given, Great Britain occupies certainly the most favorable situation of all the countries specified.

Iron versus Steel Plates.

Continuing the discussion on iron as against steel plates for ships, a correspondent of the *Newcastle Chronicle* says: In case of collision or shipwreck, I would rather trust to a ship built in watertight compartments than on the strength of the hull whether built of iron or steel. Steel is a splendid material for certain purposes; but take the case of an ordinary cargo-carrying steamer, say seven years old, laboring in a heavy gale, which would be safer—a good, stiff old iron ship or a light steel plated ship, with hull and frames weakened by corrosion and rivet heads eaten away? I fancy the verdict of most seafaring men would be in favor of the former.

How to Copper Iron.

It is stated in the *Metallarbeiter* that iron can be coppered by dipping it into melted copper, the surface of which is protected by a melted layer of cryolyte and phosphoric acid, the articles to be thus treated being heated to the same temperature as the melted copper. Another process consists in dipping the articles into a melted mixture of one part of chloride or fluoride of copper, five or six parts of cryolite and a little chloride of barium. If the article, when immersed, is connected with the negative pole of a battery, the process is hastened. A third method consists in dipping the articles in a solution of oxalate of copper and bi-carbonate of soda, dissolved in ten or fifteen parts of water, acidified with organic acid.

LIST OF PATENTS.

Relating to Iron, Steel, Metal, Machinery, Hardware and Mining Interests.

Reported expressly for this paper by H. T. Fisher, (late Ex. U. S. Patent Office), Patent Attorney, 34 Blackstone Building, Cleveland, O.

PATENTS BEARING DATE MARCH 19, 1889.

Bagassse furnace, W. W. Sutcliffe, New Orleans, La.
Bolt heading machine, E. Burdsall, Jr., Port Chester, N. J.
Furnace for working zinc ores, L. Kleeman, Myslowitz, Prussia, Germany.
Iron into malleable iron or steel, converting crude, G. L. Robert, Stenay, France; assignor to J. W. Bookwalter, Springfield, Ohio.
Metal, device for upsetting and bending and upsetting, M. Kennedy, Hegewisch, Ill.
Metallic wheel, T. Hill, Quincy, Ill.
Ore separator, A. Emmons, Galena, Kansas.
Pipes, thimble for coupling lead and cast iron, L. Wolff, Chicago, Ill.
Sash, machine for bending metal, W. F. Mills, Kalamazoo, Mich.
Zinc from ores containing precious metals, extracting, H. B. Slater, Detroit, Mich.
Zinc, manufacturing, H. A. Hunicke, St. Louis, Mo.

EXPIRING PATENTS.

Relating to the Mechanic Arts. Which Become Public Property April 2, 1889.

Furnished by F. B. Brock, Patent Attorney, 639 F St., Washington, D. C.:

Manufacture of metal screw rings, L. F. Betts.
Manufacture of iron from mill cinder, C. M. Nes.
Manufacture of artificial stone from furnace cinder, F. Lurman.
Machine for bending sheet metal, R. B. McConnell.
Iron melting furnace, G. H. Sellers.
Gas engine, G. B. Brayton.

IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND f. o. b. cars, four months: No. 1 Bessemer, $18 00@18 50; No. 1 Foundry, $17 20@17 70; No. 2 Foundry, $16 20@16 70; No. 1 Gray Forge, red short, $15 20@15 70; No. 2 Gray Forge, neutral, $14 70@15 20; No. 1 American Scotch, $17 20@17 70; No. 2 American Scotch, $16 20@16 70.

CINCINNATI reported by Rogers, Brown & Co.: HOT BLAST FOUNDRY—Ohio and Southern Coke No. 1, $15 25@15 75; Ohio and Southern Coke No. 2, $14 50@15 00; Ohio and Southern Coke No. 3, $13 75@14 25; Ohio Soft Stone Coal No. 1, $15 75@16 50; Ohio Soft Stone Coal No. 2, $14 75@15 50; Mahoning and Shenango Valley, $16 50@17 00; Hanging Rock Charcoal No. 1, $21 00@22 50; Hanging Rock Charcoal No. 2, $19 00@22 50; Tennessee and Alabamba Charcoal No. 1, $18 00@18 50; Tennessee and Alabama Charcoal No. 2, $17 00@18 50. FORGE—Strong Neutral Coke, $13 25@13 50; Mottled Neutral Coke, $12 75@13 25; Cold Short Coke, $13 00@13 50. CAR WHEEL AND MALLEABLE—Southern Car Wheel, $20 00@25 00; Hanging Rock Cold Blast, $22 00@25 00; Lake Superior Malleable and Car Wheel, $22 00@23 00.

CHICAGO reported by Rogers, Brown & Co.: COKE AND BITUMINOUS COAL FOUNDRY—Ohio Hanging Rock Softeners No. 1, $18 00@18 50; Ohio Hanging Rock Softeners No. 2, $17 00@17 50; Ohio Hocking Valley Softeners No. 1, $18 00@18 50; Ohio Hocking Valley Softeners No. 2, $17 00@17 50; Ohio Hocking Valley Silvery Pure No. 1, $17 00@00 00; Ohio Hocking Valley Silvery Pure No. 2, $16 00@00 00; Ohio Black Band, $19 00@19 50; Ohio Jackson County Softeners No. 1, $18 00@18 50; Norton and Ashland Brands Ashland, Ky. No. 1, $17 00@17 50; No. 2, $16 00@$16 50; Southern Coke Foundry No. 1, $16 50@17 00; Southern Coke Foundry No. 2, $15 75@16 25; Southern Coke Foundry No. 3, $15 25@15 75; Southern Coke, Soft No. 1, $15 75@16 25; Southern Coke, Soft No. 2, $14 50@15 00; Southern Coke, Grey Forge, $14 50@15 00; Local Furnaces at Chicago and Milwaukee No. 1 Foundry, $16 00@17 00; No. 2 Foundry, $15 00@16 00; No. 3 Foundry, $14 00@15 00. CHARCOAL FOUNDRY—Lake Superior No. 1 and 2, $20 00@00 00; Hanging Rock, $21 00@23 50; Southern, $19 50@20 50. CAR WHEEL AND MALLEABLE—Standard Southern No. 3 to 6, $20 50@25 50; Lake Superior, $20 50@21 00; Hanging Rock Cold Blast, $24 50@27 00; Hanging Rock Warm Blast, $22 00@24 00.

LOUISVILLE reported by Geo. H. Hull & Co.: Southern Coke No. 1 Foundry new classification, $14 75@15 25; Southern Coke No. 2 Foundry new classification, $14 25@14 75; Southern Coke No. 3 Foundry new classification, $13 75@14 25; Grey Forge, $13 25@13 75; White and Mottled, different grades, $12 75@13 25; Silver Grey, different grades, $13 00@13 50; Southern Charcoal No. 1 Foundry, $16 25@16 75; Southern Charcoal No. 1 Mill, $14 75@15 25; Southern Car Wheel, Standard brands, $21 75@22 75; Southern Car Wheel, other brands, $18 00@19 50; Hanging Rock Coke No. 1 Foundry, $15 50@16 00; Hanging Rock Charcoal No. 1 Foundry, $19 50@21 00; Hanging Rock Cold Blast, $20 75@23 75; Hanging Rock Warm Blast, $00 00@00 00.

ST. LOUIS reported by Rogers, Meacham & Shields: HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@16 25; Southern Coke No. 2, $15 00@15 50; Southern Coke No. 3, $14 50@15 00; Southern Grey Forge, $13 50@14 00; Southern Charcoal No. 1, $18 00@18 50; Southern Charcoal No. 2, $17 00@18 00; Missouri Charcoal No. 1, $16 00@16 50; Missouri Charcoal No. 2, $15 00@16 00; Ohio Softeners, $18 00@20 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $20 00@22 00; Southern, $19 00@24 00. CONNELLSVILLE COKE—East St. Louis, $4 70; St. Louis, $4 85.

DETROIT reported by William F. Jarvis & Co.: Lake Superior Charcoal, all Numbers, $19 50@20 00; Lake Superior Coke, all Ore, $18 75@19 25; Lake Superior Coke, Cinder Mixed, $17 75@18 25; Standard Ohio Black Band, $18 75@19 25; Southern No. 1, $17 00@17 50; Southern Gray Forge, $15 00@15 50; Southern Silvery, $16 50@17 00; Jackson County Ohio Silvery, $18 25@18 75; Old Wheels, $18 50@19 00.

PITTSBURGH reported by A. H. Childs: No. 1 Foundry, $16 50@16 75; No. 2 Foundry, $15 50@15 75; Gray Forge, $14 50@14 75; White and Mottled, $13 75@14 00; Warm Blast Charcoal, $18 00@22 00; Cold Blast Charcoal, $22 00@26 00"; Bessemer, $16 75@17 00.

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 70
4¼ to 6 by ⅜ to 1 inch	1 80
1¾ to 6 by 1⅛ to 2 inch	2 10
1¼ & 1⅜ by ⅜ to ¾ inch	1 80
1 & 1⅛ by ⅜ to ¾ inch	1 80
⅝, ¾ and ⅞ by ⅜ to ⅝ inch	2 20

Round and Square.

1 to 1⅞ inch	1 70
2 to 2⅝ inch	1 90
2¾ to 3¼ inch	2 20
3⅜ to 4 inch	2 70
4¼ to 4½ inch	3 20
4¾ to 5 inch	3 40

Oval.

⅞ to 1¼ inch	2 10
⅝ to ¾ inch	2 30
½	2 50
⅜	2 90

Half Oval and Half Round.

1½ to 3 inch	2 80
⅞ to 1¼ inch	2 40
⅝ to ¾ inch	2 90
½	3 20
⅜	4 70

Heavy Band.

1½ to 6 by ¼ and 5-16 inch	1 95
1 to 1⅜ by ¼ and 5-16 inch	2 05
¾ to ⅞ by ¼ and 5-16 inch	2 25
½ to ⅝ by ¼ and 5-16 inch	2 75

Hoops.

1¼ to 4, Nos. 13 to 15	2 55
1¼ to 2, Nos. 16 to 18	2 65
1¼ to 2, No. 19	2 75
1¼ to 2, No. 20	2 85
1¼ to 2, No. 21	2 95
1¼ to 2, No. 22	3 05
15-16, 1 and 1⅛, Nos. 13 to 15	2 75
15-16, 1 and 1⅛, Nos. 16 to 18	2 85
15-16, 1 and 1⅛, Nos. 19 and 20	2 95
15-16, 1 and 1⅛, No. 21	3 05
15-16, 1 and 1⅛, No. 22	3 25
⅞, Nos. 13 to 15	2 95
⅞, Nos. 16 to 18	2 05
⅞, Nos. 19 and 20	2 15
⅞, No. 21	3 25
⅞, No. 22	3 35
13-16, Nos. 13 to 15	3 15
13-16, Nos. 16 to 18	3 25
13-16, Nos. 19 and 20	3 35
13-16, No. 21	3 45
13-16, No. 22	3 55
¾, Nos. 13 to 15	3 25
¾, Nos. 16 to 18	3 35
¾, Nos. 19 and 20	3 45
¾, No. 21	3 55
¾, No. 22	3 65
11-16, Nos. 13 to 15	3 45
11-16, Nos. 16 to 18	3 55
11-16, Nos. 19 and 20	3 65
11-16, No. 21	3 75
11-16, No. 22	3 85
⅝, Nos. 13 to 15	3 85
⅝, Nos 16 to 18	3 75
⅝, Nos. 19 and 20	3 95
⅝, No. 21	4 05
⅝, No. 22	4 15
⅝, No. 23	4 25

Light Band.

1½ to 6 by ⅛ to 3-16 in	2 25
1½ to 6 by Nos. 11 and 12	2 35
1 to 1⅜ by ⅛ to 3-16 in	2 35
1 to 1⅜ by Nos. 11 and 12	2 45
⅞ and 13-16 by ⅛ to 3-16 in	2 65
⅞ and 13-16 by Nos. 11 and 12	2 75
¾ and 11-16 by ⅛ to 3-16 in	2 95
¾ and 11-16 by Nos. 11 and 12	3 05
⅝ and 9-16 by ⅛ to 3-16 in.	3 25
⅝ and 9-16 by Nos. 11 and 12	3 30
½ by ⅜ to 3-16 in	3 50
½ by Nos. 11 and 12	3 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	2 75
⅞ inch, " " " 13 and 14	3 05
¾ inch, " " " 11 and 12	3 05
¾ inch, " " " 13 and 14	3 25

Sheet Iron.

No. 10 to 14	2 45
No. 15 to 17	2 65
No. 18 to 21	2 75
No. 22 to 24	2 85
No. 25 to 26	2 95
No. 27	3 05
No. 28	3 25

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 35
C No. 1, " "	2 60
C H No. 1 " "	2 85
C H Flange, " "	3 55
Extra Flange, "	3 95
Solid Fire Box, "	4 85

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 55
Shell	2 95
Flange	3 20
Marine Flange	3 70
Fire Box	4 35

Above includes plates 90 inches wide.

90 to 96 in. wide	½c ℔ extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1½c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.

	cts. ℔s
1 to 2 in. inclusive	09
9-16 to ½ in "	09
7-16 to ⅜ and 2⅜ to 3 in	10½
3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

	cts. ℔s
2 to 9-16 wide by 2 to ⅝ thick	0

Bessemer and O. H. Steel.

	ct. ℔
Machinery	base price, 02¾
Tire	" 02¾
Spring	" 03¼
Sleigh Shoe	" 02¾
Toe Calk	" 03
Cutter Shoes, tapered and burr	" 03

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

SCRAP IRON AND OLD METAL.

	Net Ton.
No. 1 R. R. wrought scrap	$19 20
No. 1 wrought scrap	18 00
No. 1 Machine cast scrap	14 00
Stove Plate free from burnt iron	10 50
Grate Bars	9 00
Pipes and flues Clean	13 00
Tank iron	12 50
Hoop and band iron	10 00
Iron axles	24 00
Light sheet iron	10 00
Axle turnings	15 00
Wrought turning free from cast	13 00
Wrought iron, oily drillings	12 00
Cast borings	10 00
Malleable iron	11 50
Uncut wrought iron boilers	10 00
Steel boiler plates	14 50
Old iron T rails	gross tons 22 00
Old steel rails	19 50
Car wheels	20 00
Old copper	℔ 10
No. 1 H. red Brass	11
Heavy yellow brass	9½
Light yellow brass	6
Scrap Zinc	3
Tea Lead	3
Heavy Lead	3¼

PITTSBURGH & WHEELING COAL CO.,
MINERS AND SHIPPERS OF
Ohio Steam Coal and Coke.
Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 2,000 tons daily.
Office, 29 Mercantile Bank Building.
CLEVELAND, OHIO.
Lake Shipping Point, Lorain O.

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wrights	℔ 9½

Bellows.

Blacksmiths'	Hill's dis 40
	Bullock's dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co's standard	dis 70@70& 5
" " " extra	dis 60&5@60&10
" " " best	dis 55
Hoyt's Short Lap	dis 45
Cleveland Rubber Co. extra standard	dis 60&10
Shultz Raw Hide Leather Belting, single	dis 30
Shultz Raw Hide Leather Belting, double	dis 35
Standard, oak tanned	dis 55@60
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 35

Borax.

	℔ 9½@10½

Chalk.

White	℔ gross 50
White Crayon	℔ gross 12@12½
Red	dis 70
Blue	dis 85

Chucks.

Cushman's 4 Jaw Independent	dis 40
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 25
" Drill	dis 35
Wescott's Scroll Combination	dis 30
" Independent	dis 40
" Little Grant Drill	dis 30
Horton's Universal & Ind	dis 40
National Combination	dis 40
Sweetland "	dis 40
Skinner "	dis 40
" Light Independent	dis 50
Almond Drill	dis 25
Morse "	dis 15

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Brown & Sharpe, Milling Cutters	dis 15
" " " Gear Cutters	dis 15

Crowbars.

Cast Steel	℔ 4
Iron, steel points	℔ 3½

Drill and Drill Stocks.

Twist drills	dis 50&10
Morse Taper and Straight shank to 1½"	dis 50&10
Morse Taper and Straight shank Larger than 1½"	dis 25
Drill Sockets	dis 20
Standard	dis 50&10
Cleveland	dis 50&10

Emery.

	No. 4 to No. 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ℔	4 c	5 c		2½c
½ kegs ℔	4¼c	5¼c		2¾c
¼ kegs ℔	4½c	5½c		3 c
10 ℔ cans, 10 in case	6 c	6½c		5 c
10 ℔ cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co	dis 40@46
H. H. Barton	dis 40@46

Emery Wheels.

Detroit	dis 50@60
Norton's	dis 55@60
Grant	dis 55@60
Union Stone	dis 60
Sterling	dis 60
Vulcanite	dis 15@20
Celluloid	dis 10
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60

Files.

Nicholson	dis 60&10@60&10&10
" X. F.	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
Arcade	dis 65@70
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 ℔s. 18c over 5 ℔s 14c, new list.	

Jack Screws.

Illinois Bolt Co. list	dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3½	3½
Hexagon	15½	11½	8½	6	5¾	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 ℔s, ℔ add ½c., 1 ℔ boxes add 1c to list.

Nails (wire.)

List July 14, 1887	dis 70 &10
Standard Penny Nails, ℔ keg card rate	
	Car lots $2.50
	Less than car lots $2.60

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ℔ doz	dis 10@10&10

Packing, Steam.

Boston Belting Co.	dis 60
American Packing Hemp	℔ 10@11
Russia Packing "	℔ 14
Italian Packing "	℔ 13@14
Plumbago Piston	℔ 40
Morrison's "	℔ 50
Square Flax "	℔ 70
Sheet Rubber	℔ 12@24
Excelsior Rubber	℔ 48

Picks.

Railroads, 5 to 6 ℔s	$12 dis 60&5@60&10
" 6 to 7 ℔s	$13 dis 60&5@60&10

Pulleys.

Iron Pulleys, Walker List	dis 45
Medart Pulleys	dis 55
Split Wood Pulleys	dis 45

Rivets.

Iron, Thousand, list November 17,	dis 50@50&10
Iron, Ordinary, Cooper's Block and Carriage list November 17	dis 50
Copper	dis 50@50&10

Rope.

Manilla, ½ inch and over	℔ 15¼
Sisal, ½ inch and over	℔ 13¼

Sand Paper.

B. A. & Co.	dis 40@40&10
H. H. Barton's	dis 40@40&10
New England Flint	dis 40@40&10
Barton's Garnet	dis 20

Saws.

Disston's Circular	dis 45
" Band	dis 20
" Scroll	Net
Hack Saw Stubs	dis 20
" " Eureka	dis 20
" " Star	dis 20
Saw Swages Disston's	dis 20

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron	dis 50
Round head iron	dis 40
Flat head brass	dis 45
Round head brass	dis 35
Square Cap	dis 65
Hexagon Cap	dis 60
Set C. H. C. P.	dis 70
Machine, flat head, iron	dis 55
Machine, round head, iron	dis 50
Bench and hand—	
Lag or coach	dis 75@75&10
Coach, patent gimlet point	dis 75

Shovels and Spades.

Ames' list November 1, 1885	dis 20
Dennis	dis 5.25
Hussey & Binns, railroad	dis 8.00

Taps.

Cards, Hand and Nut to 2 in.	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " "	dis 25
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 50
Pulley Taps	dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ ℔ Balls		21c@29c
No. 18 " " ¼ and ½ "		18c@28c
No. 36 " " ¼ and ½ "		16c@27c
2-Ply Hemp, ¼ & ½ ℔ Balls (Spring Twine)		11½c
3-Ply " 1 ℔ Balls		12@12¼c
3-Ply " 1½ ℔ Balls		11@11¼c
Cotton Wrapping, 5 Balls to ℔		15@16c

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 10@15
Howard	dis 30

Wire.

New List, Jan. 18, 1884

Brass and copper	dis 20@25
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis 65&5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	$6.00@℔ dis 30

Wrenches.

Coe's genuine, cash in ten days	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanics'	dis 55&10,& 3
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 10
William's " "	dis 10
Alligator " "	dis 40

CONDIT, FULLER & CO.,
Pig and Bar Iron,
CLEVELAND, OHIO.

H. P. Hussey. Geo. H. Pomeroy.
HUSSEY & POMEROY,
EXCLUSIVELY PIG IRON,
Strong Foundry and American Scotch Irons, Gray Forge and Bessemer Irons for steel purposes.
Room 57, Grand Arcade, Cleveland, O.

Pickands, Mather & Co.,
IRON ORE - -
—AND—
- - PIG IRON
Corner Bank and Superior Streets,
CLEVELAND, O.

J. H. OUTHWAITE. W. G. POLLOCK.
J. H. OUTHWAITE & CO.,
Exclusive attention given to
LAKE SUPERIOR AND MENOMINEE RANGE
Iron Ore,
CLEVELAND, OHIO.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ₱ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ₱ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $2 75@3 25
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....₱dox. $6 00@6 50
Others.....₱doz. $5 50@5 75
Full polished.....$8 00

Bolts.

Cast iron barrel bolts.....dis 70@70&10
Cast iron shutter bolts, etc.....dis 70@70&10
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70@70&10
Wrought iron square bolts.....dis 70@70&10
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&2½&2
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 62½
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Butts.

Wrought brass.....dis 70@70&10
Cast brass, loose joint.....dis 33⅓&10
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60&5
Fast joint, broad.....dis 55&10&5@60&10
Loose joint.....dis 70&10@75
Loose joint, jap.....dis 70&10@75
Loose joint, jap. with acorns.....dis 70&10@75
Loose pin, acorns.....dis 70&10@75
Loose pin, japanned acorns.....dis 70&10@75
Loose pin, acorns, jap. plated tips..dis 70&10@75
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10@75
Wrought, fast joint, broad.....dis 70&10@75
Wrought, loose joint, broad.....dis 70&10@75
Table Butts, back flaps, etc.....dis 70&10@75
Regular inside blind.....dis 70&10@75
Light inside blind.....dis 70&10@75
Loose pin.....dis 70&10@75
Light loose pin.....dis 70&10@75

Chains.

Trace, 6½-10-2.....₱ pair 1.03)
Trace, 6½-10-3.....₱ pair .92) 50&10@50&10&5
Trace, 7-10-2.....₱ pair 1.11)
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887..dis 50&10&5@60
Galvanized Pump Chain.....₱ lb5½@6
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 70@70&5

Chisels.

Socket Framing and Firmer.....dis 75&5@75&10
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....₱ gross $12, dis 25@25&5

Hangers.

Barn door, old patterns.....dis 60&10&10@70
Climax, Anti-Friction.....dis 70
Star.....dis 40&10@40&10&5
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

	No. 10	9	8	7	6	
Ausable, ₱ lb.	23	24	25	26	28	dis 25&10@25&10&10
Putnam, ₱ lb.	18	19	20	21	23	dis 15

Essex.....dis 25&10@25&10&10

Horse Shoes.

Burden, at factory.....₱ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....₱ keg $4 00
Mule Shoes, at factory.....₱ keg $5 00

Knobs.

Carriage, japanned.....₱ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbear, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 66⅔
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps,genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 66⅔
Letter box plates, genuine bronze.....dis 60&10
Barn door locks.....dis 33⅓

Plumbs and Levels.

Standard list.....dis 70&10@70&10&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout,best makers.dis 60&10@60&10&10
Pitcher spout,cheaper goods dis 70&5@70&10&5

Rakes.

Cast steel.....dis 65
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@[illegible].....dis 10
Rifle razor.....dis $9 50 net

Scales.

Hatch, Counter, No. 171.....₱ doz $21 00
Hatch, Tea, No. 161.....₱ dox $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....₱ doz $18 dis 25

Squares.

Steel and iron.....
Nickel plated.....dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, January 2, 1888.

American iron carpet tacks all kinds.....dis 80@80&5
Steel carpet tacks all kinds.....dis 80@80&5
Swedes iron carpet tacks, all kinds.....dis 80@80&5
Swedes iron tacks.....dis 75&5@75&10
Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
Tinned Swedes iron tacks..dis 75&10@75&10&5
Tinned Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
American iron cut tacks.....dis 75@75&10
Copper tacks.....dis 50&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10@50&10&5
Finishing nails.....dis 70&10@70&10&10
Hungarian nails and miners' tacks.....dis 70&10@70&10&10
Gimp and lace tacks.....dis 75&10@75&10&5
" " " tinned.dis 75&10@75&10&5
Trunk and clout nails.....dis 70&10@70&10&10
Tinned trunk&clout nails.dis 70&10@70&10&10
Basket nails.....dis 70&10@70&10&10
Chair nails.....dis 70&10@70&10&10
Common and patent brads.dis 70&10@70&10&10
Tinned capped trunk n'ls..dis 70&10@70&10&10

TUTTLE, OGLEBAY & CO.,
Commission Dealers in
Iron - Ores,
FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS,
CLEVELAND, OHIO.

DALLIBA, CORRIGAN & CO.,
DEALERS IN
Iron Ore & Pig Iron.
101 St. Clair St., Rooms 20 to 22,
CLEVELAND, O.

LABORATORY
— OF —
CHEMISTRY - AND - PHYSICS.
Tests of Ores and Strengths of Material requiring expert work a specialty. Address,
J. F. ELSOM,
New Albany, Indiana.

ECLIPSE ELECTROTYPE AND ENGRAVING CO.
AUST & CLARK PROPRIETORS
LITHOGRAPH BUILDING CLEVELAND, O.

A 1. BABBITT.
The only genuine Allen's Black Lead Compound Babbitt. Perfect satisfaction guaranteed. The cheapest metal made, quality considered. Address all orders to
W. L. FAY & CO., Sole Mfrs., Elyria, O.

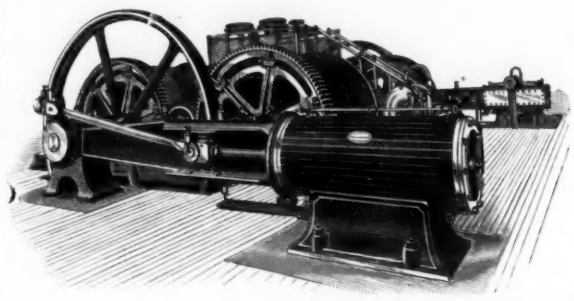
PATENTS THOS. P. SIMPSON, Washington, D.C. No att'yfee until patent obtained. Write for inv't'rs guide.

Two Books for Foundrymen.

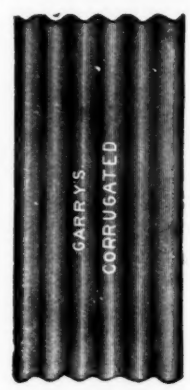
AMERICAN FOUNDRY PRACTICE.
BY THOS. D. WEST.
Treating of Loam, Dry Sand and Green Sand Moulding, and containing a Practical Treatise upon the management of Cupolas and the Melting of Iron.

West's Moulder's Text-Book
Being Part II of American Foundry Practice.
Presenting best methods and original rules for obtaining good, sound, clean csatings, and giving detailed description for making moulds requiring skill and experience.
Also containing a practical treatise upon the construction of cranes and cupolas, and the melting of iron and scrap steel in iron foundries. Either of the above books will be sent by mail, postage paid, $2.50; or, on receipt of $3.00, the IRON TRADE REVIEW will be sent one year, with either of the above books as a premium. Address
CLEVELAND PRINTING AND PUBLISHING CO.,
CLEVELAND, OHIO.

VIDVALE TOOL STEEL & C. STEEL BLOOMS BILLETS AND SLABS W. F. THORNTON CLEVELAND O.

Webster, Camp & Lane Machine Co.

MANUFACTURERS OF
Mining Machinery,
Improved Band Friction Hoisting Machinery. Geared or Direct Acting, for round or flat rope.
Wire Rope Haulage Machinery,
Endless or Tail Rope Systems.
CORNISH PLUNGER AND BUCKET LIFT PUMPS.
Automatic or Slide Valve Steam Engines, Sheaves, Cages, Buckets, Etc.
Send for Catalogue D. 134 N. Main St., AKRON, OHIO.

CLEVELAND ROLLING MILL CO.,
MANUFACTURERS OF
BESSEMER STEEL RAILS,
Blooms and Billets, Steel Angles, Forgings, Bar and Spring Steel, Steel Street Rails, Steel Oil Barrel Hoops, Wire of all Kinds, Iron and Steel Boiler Plates, Galvanized and Black Sheet Iron, Corrugated Iron Roofing, Sheet Steel.



GARRY IRON ROOFING COMPANY,
The Largest Manufacturers of Iron Roofing in the World,
MANUFACTURERS OF ALL KINDS OF
Iron Roofing, Crimped and Corrugated Siding, Iron Tile or Shingle, Fire-Proof Doors and Shutters, Iron Ore Paint and Cement.
Iron Frames for Roofs and Buildings.
No. 152 MERWIN ST., CLEVELAND, OHIO.
Send for circulars and price list. 40.

GOBEILLE PATTERN WORKS,
Largest Shop in the U. S.,
CLEVELAND, O.

Combined Punch and Stock Shear.
Seven sizes with 8", 10" or 12" blades, and 6" to 15" Throat Punch. Weigh 100 to 600 pounds. For light or heavy work, Boiler and Stack Builders, Carriage and Copper Smiths, and Railing Makers, &c. Can punch near the edge, Angle and Flange Iron, Pipe and Stacks, Etc.
ADAPTED for cutting Bar Iron, especially Sheet Iron of all kinds, for Trimming, Slitting, Etc. Also make the Punch and Shear separate.
TOOLS FOR WORKING SHEET METAL.
Squaring Shears and Slip Roll or Plain Forming Rolls, &c.
Bertch & Co.,
CAMBRIDGE CITY, IND.
Write for circulars and mention this paper.

Fulton Steam Boiler Works,
JOHN T. CAULFIELD, Proprietor,
MANUFACTURER OF
STEAM BOILERS
Also Smoke Stacks, Tanks, Pans, Breachings, Heaters, Etc.
Works just North of Union Passenger Depot, RICHMOND, IND.
Write for Estimates.

ART PRINTING AND DESIGNING

Telephone 852.

BLANK BOOK MANUFACTURING,
BOOK-BINDING,
STATIONERY,
ENGRAVING, ELECTROTYPING,
ETC., ETC.

The Cleveland Printing & Publishing Co.

WHEN IN NEED OF A FINE CATALOGUE WRITE FOR ESTIMATES.

PUBLISHERS AND PROPRIETORS
THE IRON TRADE REVIEW.

Corner St. Clair and Wood Sts.,
CLEVELAND, O.

TRAVELERS' REGISTER.

Standard Time.
Revised March 6th, 1888.

N. Y., C. & St. L. R. R. Co.—"The Nickel Plate."

Eastward.	Arrive.	Depart.
Buffalo Passenger	10 40 a m	10 45 a m
Chicago Passenger	9 20 p m	.....
Local Freight	4 40 p m	7 30 a m
Westward.	**Arrive.**	**Depart.**
Chicago Passenger	.....	6.30 a m
Fostoria Passenger	5 06 p m	5 11 p m
Local Freight	1 00 p m	5 50 a m

Rocky River Accommodation departs 7:40 a. m.; 1:40 p. m.
Euclid Accommodation departs 6:24 a. m.; 5.05 p. m.
All trains daily, except Sunday.

Cleveland & Pittsburgh.

	Arrive.	Depart.
New York Express	12 50 p m	7 45 a m
New York Express	6 35 p m	1 35 p m
Alliance & Akron Accom	9 35 a m	3 25 p m
Ravenna Accommodation	8 25 a m	5 00 p m
Night Express	*5 25 a m	*11 10 p m

*Daily; all other trains daily, except Sunday.

Mt. Vernon & Pan Handle Route.

C., A. & C. Ry. Co.	Arrive.	Depart.
Akron, Col. & Cin. "Flyer"	5 40 p m	8 10 a m
Akron, Col. & Cin. Night Express	7 00 a m	8 00 a m
Akron, Col. & Zanesv'e Ex	12 50 p m	1 35 p m
Akron & Orrville Accom	9 35 a m	3 25 p m

The 8 p. m. train runs daily. Elegant Pullman palace sleeping cars attached. All other trains daily, except Sunday.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo	.....	†6 40 a m
Pittsburgh Express	†6 25 p m	.....
Youngstown Local	†8 05 a m	.....
Mahon'g div. & Pitts Local	.....	*11 40 a m
Mahoning Val. Accom	.....	†4 30 p m
Pittsburgh Express	†1 20 p m	11 10 p m
New York Express	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

Depart—
Canton and Coshocton—7:00 a. m., 3:15 p. m.
Bedford—7:00 a. m., 11:10 a. m., 2:00 p. m., 3:15 p. m., 4:40 p. m., *5:45 p. m., 10:35 p. m.
Newburgh—6:12 a. m., 7:00 a. m., 11:10 a. m., 2.00 p. m., 3:15 p. m., 4:40 p. m., *5:45 p. m., 7:30 p. m., 10:35 p. m.
Kent—7:30 a. m., 3:15 p. m., *5:45 p. m.
Arrive from—
Canton and Coshocton—8:50 a. m., 6:55 p. m.
Bedford—6:00 a. m., *8:12 a. m., 9:50 a. m., 1:05 p. m., 4:05 p. m., 6:40 p. m., 7:10 p. m.
Newburgh—6:00 a. m., *8:12 a. m., 9:50 a. m., 1.05 p. m., 4:05 p. m., 6:40 p. m., 7:10 p. m., 9:10 p. m.
Kent—*8:12 a. m., 9:50 a. m., 6:55 p. m.

Theatre train leaves Cleveland 10:35 p. m. and runs through to Newburgh and Bedford daily, except Sunday.
Trains marked with * run daily. All others daily, except Sunday.
Depot at Ontario St., opposite Huron St.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail	*7 45 a m	*6 30 p m
Marietta Express	†11 15 a m	†2 30 p m
Valley Junction Express	*4 15 p m	*10 15 a m
Cleve. and Canton Express	*7 00 p m	†8 15 a m

*Daily. †Daily, except Sunday.

WM. THORNBURGH, Gen. Manager. R. A. CARRAN, Gen. Pass. Agt.

Cleveland, Lorain and Wheeling.

All trains arrive and leave the Union Depot as follows:

	Depart.	Arrive.
Wheeling Express	6 45 a m	6 55 p m
Uhrichsville Express	4 00 p m	9 20 a m

OSCAR TOWNSEND Gen. Mang'r.

ERIE RAILWAY.

THE FAVORITE
—AND—
PICTURESQUE ROUTE
—TO—
New York, Boston and the East.

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the Southeast.

New Central Depot So. Water St. and Viaduct.

	Depart.
No. 62, Accommodation	† 6 00 a m
No. 72, New York Express	* 8 30 a m
No. 72, Fast Pittsburgh Express	* 8 30 a m
No. 64, Fast Pittsburgh Express	* 3 00 p m
No. 66, Leavittsburgh Accommo	* 4 20 p m
No. 68, Pittsburgh Express	†10 50 p m
No. 68, New York Express	†10 50 p m
No. 70, Pittsburgh Local Express	†11 45 a m
No. 74, Youngstown Express	† 4 20 p m
	Arrive.
No. 65, Fast New York Express	*12 50 a m
No. 61, Pittsburgh Express	* 7 35 a m
No. 67, Pittsburgh Express	†10 55 a m
No. 63, New York Express	* 6 50 p m
No. 63, Pittsburgh Express	* 6 50 p m
No. 69, Pittsburgh Local Express	† 9 10 p m
No. 13, Accommodation	† 5 25 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad, South Water street and Viaduct, Cleveland.
A. M. TUCKER, Gen. Supt., Cleveland, O.
L. P. FARMER, Gen. Pass. Agt., New York.
W. C. RINEARSON, Ass't G. P. A., Cleveland, O.
M. L. FOUTS, City Pass. and Ticket Agt., 141 Superior st., Weddell House, Cleveland, O.

—THE—
Cleveland & Marietta Ry.

THROUGH TRAINS
BETWEEN
Toledo, Cleveland and the Ohio River.

The shortest and best Route via Marietta to

Washington, D. C., Charleston, W. Va., Parkersburg, W. Va., and the South.

Direct connections at Union Depots, with all great through lines to all Points

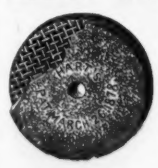
WEST, NORTHWEST, SOUTH, SOUTHWEST AND SOUTHEAST.

Lowest Rates. Quickest Time. Best Accommodations.

Tickets sold and baggage checked through to destination. Reliable information and best rates will be furnished by any agent of the Popular C. M.

A. T. WIKOFF, Pres. and Gen. Mgr. W. K. RICHARDS, G. P. & T. A.

EMERY WHEEL MACHINERY.



J. Wendell Cole, M. E.
Manager of Pennsylvania and Southern Lake regions and the Northwest, for
DETROIT EMERY WHEEL CO.
Address: Box 84, Columbus, O., or P. O. box 152, Chicago.
Hart's Corundum-Emery Wheels.

Wheeling & Lake Erie Railway.
THE NEW THROUGH LINE
BETWEEN
TOLEDO
—AND—
Bowerston, Pittsburgh, Marietta.
THROUGH COACHES
BETWEEN
Toledo & Marietta.
Through Sleepers Between
PITTSBURGH AND CHICAGO.
AND DAY COACHES BETWEEN
Toledo and Pittsburgh, Via Akron, Cuyhoga Falls, Kent, Ravenna, Leavittsburg, Warren, Niles, Girard, Youngstown, New Castle and Allegheny.

The Only Line running through
"BEAUTIFUL ZOAR."

This line will be completed to Wheeling in July, 1889.

M. D. WOODFORD, Gen'l Manager. JAS. M. HALL, Gen'l Pass. Agent.

PITTSBURGH AND LAKE ERIE RAILROAD.

"Cleveland & Pittsburgh Short Line."

Twenty (20) Miles Shorter than any other route between Cleveland and Pittsburgh and the South East.

5 Through Trains Daily 5

FAST TIME. NO DELAYS.

"For scenery picturesque and varied,
Through valleys green, 'mong mountains ser-
The people's favorite route I ween, [ried,
The P. & L. E. sits enthroned as queen."

See that your tickets read via
THE PEOPLE'S FAVORITE ROUTE.

E. HOLBROOK, Gen'l Supt., A. E. CLARK, G. P. & T. A. Pittsburgh, Pa.

Sebastian, May & Co.'s
Improved Screw-Cutting
Foot or Gear Power LATHES.

Catalogue of Lathes, Drill Presses & Machinists' Tools and Supplies mailed on application. **Lathes on Trial.**
164 W. Second St., CINCINNATI, O.

THE PICTURESQUE
Lehigh Valley Route.

Two through trains with Pullman cars attached are now run via this beautiful scenic route, between Suspension Bridge, Buffalo, New York and Philadelphia, leaving Suspension Bridge 8:35 A. M. and 3:40 P. M., Buffalo 9:15 A. M. and 5.30 P. M., connecting with all trains from the West.

Passengers between the East and West passing over the famed

LEHIGH VALLEY ROAD

will experience the pleasure of a trip through the most magnificent and picturesque scenery in the world, presenting an ever-varying panorama of delightful surprises.

Double track, steel rails, magnificent road bed and unrivaled equipment, all combine to make the

LEHIGH VALLEY

the favorite and most desirable route between the East and the West.

Anthracite coal is used entirely, guaranteeing the passengers perfect freedom from the dense volumes of smoke that so greatly annoy passengers on lines using Bituminous Coal.

E. B. BYINGTON,
Gen'l Pass. Agt., South Bethlehem, Pa.

MURRAY & HEISS
"THE BECKMAN"
204 SUPERIOR ST.
CLEVELAND, O.

WOOD ENGRAVING.
ELECTROTYPING.
PHOTO-ENGRAVING
BY LINE AND HALF TONE.

SCIOTO VALLEY RAILWAY.

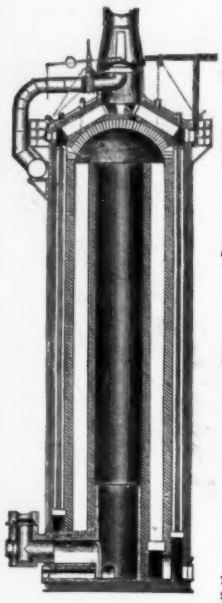
Direct route, Columbus, O., to Circleville, Chillicothe, Waverly, Portsmouth, Ironton and Ashland, Ky. Three trains daily except Sunday. Favorite route, North and West, making close connection at Ashland, Ky., with the Chesapeake & Ohio Ry., through the canons of New River, passing White Sulphur Springs and the many Summer resorts of the Alleghenies in Virginia.

Shortest and Quickest Route to Richmond, Lynchburg, Newport News, Old Point Comfort.

J. ROBINSON, Receiver, Columbus, O. JNO. J. ARCHER, Gen'l Pass. Agt.

McClure & Schuler,

ENGINEERS & CONTRACTORS.



Bissell Block,

PITTSBURGH, PA.

Blast Furnace CONSTRUCTION A SPECIALTY.

Sole agents for

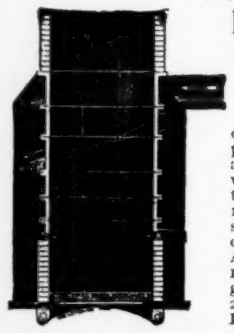
Massick's & Crooke's PATENT **Fire Brick Stoves.**

Designs and Estimates for the construction of Blast Furnace Work, and for all kinds of Hot Blast Fire Brick or Pipe Stoves; and all other kinds of Brick Work pertaining to Steel Plants, Iron, Brick or Wooden Buildings, all kinds of Iron Construction in general.

We propose to guarantee and put into successful operation all the plants we design and contract for.

"THE COLLIAU"

New and Improved



Hot Blast Cupola,

(patent March, 1884,) and New Smokeless and Automatic **FEED BOILER,** (pat. 1886 in U. S.) Correspondence solicited for plans of foundries and the economical working of cupolas, the saving of fuel in melting iron and steel, and in the production of steam. Address VICTOR COLLIAU, Mechanical Engineer and Architect, 287 Jefferson Ave., Detroit, Mich.

Alex. Laughlin & Co.,

ENGINEERS AND CONTRACTORS,

WADE BUILDING, CLEVELAND, O.

Will contract to erect, equip and place in operation Rolling Mill Plants of every description.

Regenerative Gas Furnaces

—AND—

ARTIFICIAL GAS PRODUCERS,

A Special Feature. Estimates Furnished on Application.

EVAN JONES, Southern Agt.,

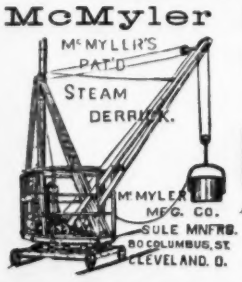
KNOXVILLE, TENN.

McMyler Manufacturing Co.,

180 COLUMBUS STREET, CLEVELAND, O.,

Sole Manufacturers of the

McMyler Patent REVOLVING STEAM Derrick.



Also general Hoisting and Conveying Machinery, Ore & Coal Buckets & Dump Cars.

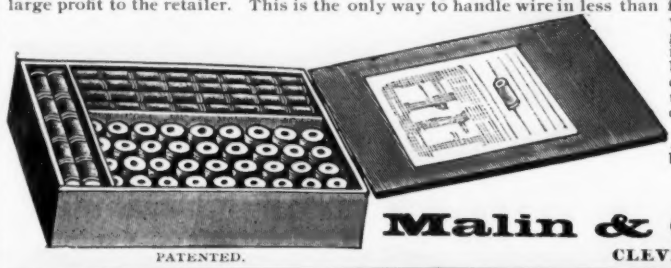
SHEPARD'S NEW $60 SCREW CUTTING Foot Lathe

Foot & Power Lathes, Drill Presses, Scroll-Saw Attachm'ts, Mandrels, Chucks, Twist Drills, Dogs, Calipers, etc. Lathes on trial. Lathes on payment. Send for catalogue of Outfits for Amateurs or Artisans. Address **H. L. SHEPARD, Agt.,** 124 East Second St., Cincinnati, O.

Retail Dealers' Stock of Spooled Wire

In Painted Wooden Box with Hinged Cover.

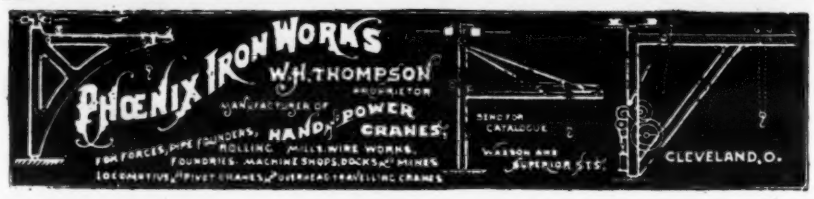
This assortment contains over 140 Spools of Black and Tinned Annealed Steel, Copper and Brass Wire, and Comprises almost every size likely to be called for. It has been put up by us especially to meet the demands of the Retail Hardware Trade, and it covers all of the most salable sizes without any dead stock. It will readily bring over $10.00 at retail and represents a large profit to the retailer. This is the only way to handle wire in less than full bundles, as it will not rust, tangle or tarnish, and is convenient for both dealer and consumer. Write us for a net price on the whole assortment, or order it from your jobber.



PATENTED.

Malin & Co.,

CLEVELAND, OHIO


PHOENIX IRON WORKS
W. H. THOMPSON PROPRIETOR
MANUFACTURER OF HAND & POWER CRANES
FOR FORGES, PIPE FOUNDERS, ROLLING MILLS, WIRE WORKS, FOUNDRIES, MACHINE SHOPS, DOCKS & MINES
LOCOMOTIVE, RIVET CRANES, OVERHEAD TRAVELLING CRANES
SEND FOR CATALOGUE
WASSON AVE & SUPERIOR STS.
CLEVELAND, O.

THE

Cincinnati Corrugating Co.

Soft Steel Plates and Sheets,

CORRUGATED ROOFING

Galvanized Iron. Patented Leveled Sheet.

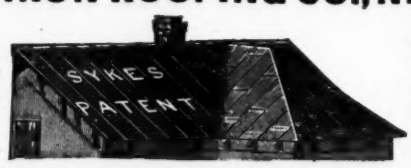
THE STANDARD IRON COMPANY,

BRIDGEPORT, OHIO.

SYKES IRON ROOFING CO., NILES, O.

CRIMPED

SYKES' IMPROVED Best Roof in the World. Suitable for all classes of Buildings. Easy Put On.



All my Iron is Re-Rolled and Box Annealed, well Painted on both sides with Best of Paint and Pure Linseed Oil.

CORRUGATED

Send for Circular and Price List, and mention this Paper.

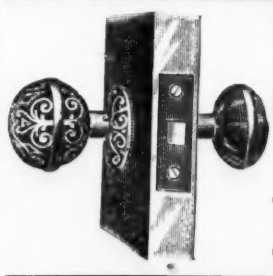
J. D. SMITH & CO., Cincinnati, O.,

Manufacturers of Every Description of

FOUNDRY FACINGS, BLACKINGS AND FOUNDRY SUPPLIES.

PLUMBAGO FOR ALL PURPOSES.

Radiant Facings and Blackings, Standard Core Compound, New Process Brass Moulding Sand. Illustrated catalogue and price list furnished on application.



Cuyahoga Manufacturing Co.,

MANUFACTURERS OF PATENT

BURGLAR ALARM DOOR KNOBS

—AND—

Burglar Window Alarms.

Cheapest, most Reliable and most durable Burglar Alarms on the Market.

Grand Arcade, Cleveland, O. Agents Wanted.

For First Class **STEAM BOILERS, STACKS, SHEET IRON & PLATE WORK, OIL AND WATER TANKS.**

BOILERS

ADDRESS: ENTERPRISE BOILER Co. YOUNGSTOWN, OHIO.

E. E. Garvin & Co.,

MANUFACTURERS OF

MACHINISTS' AND IRON WORKERS' TOOLS,

Lathes, Planers, Milling Machines & Drills.

We received **GOLD MEDAL** for our New UNIVERSAL MILLER at the N. O. Exposition. (See cut.)

Special Tools for all kinds of Manufacturing to order. Gear and Rack Cutting, Milling and Index Drilling to order.

139-143 Center St., NEW YORK.

E. H. JONES & CO.,

223 and 225 River St., CLEVELAND, O.

ENGINEERS AND CONTRACTORS.

Worthington Steam Pumps, Electric Light Engines and Automatic and Slide Valve Engines of all Descriptions.

Steam Plants, Complete, Furnished and Set Up.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

GEO. P. BURWELL, Gen'l Agt., 208 Superior St., Cleveland, O.
C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland, O.
A. D. BAITH, Special Agt., 208 Superior St., Cleveland, O.
A. D. BRIGGS, Special Agt., 208 Superior St., Cleveland, O.
J. E. WOLCOTT, Special Agt., Akron, O.

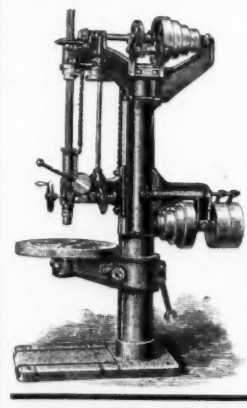
Drilling Machines,

UPRIGHT AND RADIAL.

For Cuts and Prices, address

Bickford Drill Co.,

170-180 E. FRONT ST., CINCINNATI, O.



NEW OTTO RUBBER TIRE BICYCLES.

NO STRONGER BICYCLE MADE.

A. W. GUMP & CO., Dayton, O.

52-inch,	factory price	$60.00,	our price	$40.00
50	"	"	"	55.00,	"	"	35.00
48	"	"	"	50.00,	"	"	33.00
46	"	"	"	45.00,	"	"	30.00
44	"	"	"	40.00,	"	"	27.00

Order quick. Also 250 second-hand Wheels. Repairing and Nickeling. Bicycles and Guns taken in trade.

PATENTS.

M. D. & L. L. LEGGETT,

Attorneys at Patent Law.

Patents obtained in the United States and in Foreign countries.

Masonic Building, CLEVELAND, O.

BUNDY RADIATORS

Steam and Hot Water.

10,000 pleased parties using an aggregate of over **12,500,000** square feet of Bundy Radiators attest to their superiority.

IF YOU DOUBT THIS

We will send the list and consider it a favor if you will write to the parties for their opinion.

Send for catalogue with new designs of **Arabesque** Radiators for **Oriental, Moorish** and other Queen Anne rooms.

A. A. GRIFFING IRON COMPANY,

673 Communipaw Ave., Jersey City, N. J.

N. D. FISHER, Prest. and Gen. Mgr. E. L. FISHER, Vice Prest. and Treas. A. M. ALLYN, Sec.

THE

Fisher & Wilson

COMPANY,

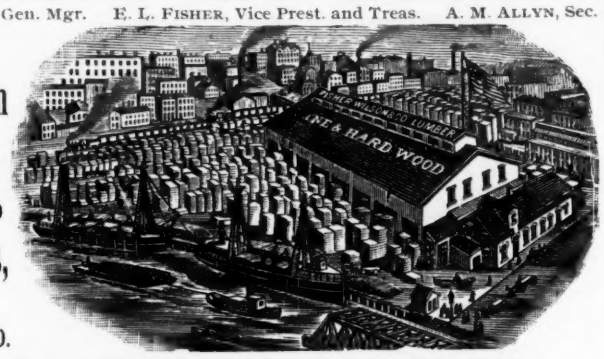
Wholesale

PINE & HARD WOOD

Lumber Dealers,

47 Central Way,

CLEVELAND, - OHIO.



Fine Hard Wood Finishing Lumber a Specialty.

Plain Oak, Quartered Oak, Ash, Cherry, Walnut, Yellow Poplar, Hickory, Red Birch, Rock Maple, Bird's Eye Maple, White Maple, Beech, Elm, Southern Pine.

BRIDGE AND CAR TIMBER CUT TO ORDER.

The Kilby Manufacturing Co.,

CLEVELAND, O.,

SUCCESSORS TO

The Prospect Machine & Engine Co., of Cleveland, O., and Barney & Kilby, of Sandusky, O.

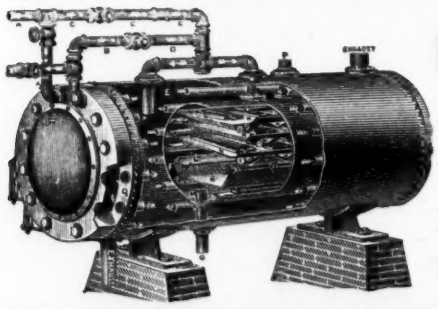
Recent extensive additions to our shops and Machinery makes our Plant one of the largest and best equipped in the country.

We are now prepared and have facilities for doing Foundry and Machinist work of every description. Shall be glad to furnish estimates on application for Engines, Boilers and other heavy Machinery.

THE - ARMSTRONG - PURIFIER,

—WITH—

EXHAUST HEATER COMBINED.



Purifies the feed water by means of the live steam, and heats the water up to the boiling point by means of exhaust steam.

A full description of this heater, together with a valuable treatise on steam boilers, sent to any address, free of charge. Address,

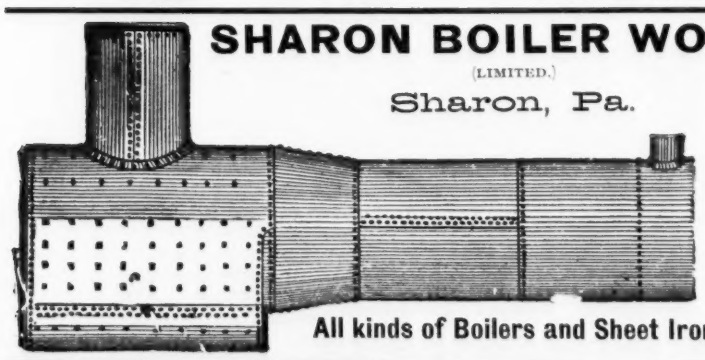
W. C. Armstrong & Co.,

SPRINGFIELD, OHIO.

SHARON BOILER WORKS,

(LIMITED.)

Sharon, Pa.



All kinds of Boilers and Sheet Iron Work.

CLEVELAND FOUNDRY.

Castings

For Machinery and Rolling Mills.

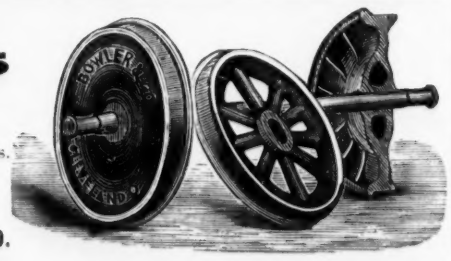
CAR WHEELS

All sizes and kinds, with and without Axles.

Chilled Faced R. R. Frogs,

ST. RAILROAD TURNOUTS.

Nos. 9, 11 and 13 Winter Street. } **BOWLER & CO.**



WORSWICK

M'F'G CO.

Cleveland, Ohio,

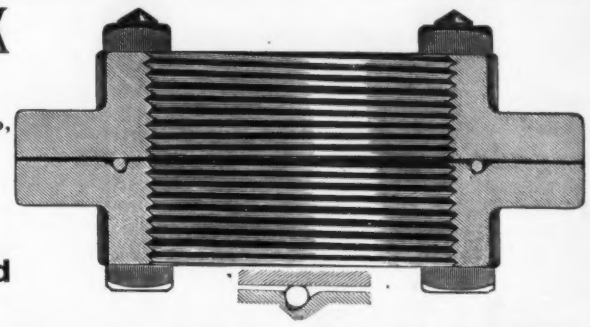
Manufacturers of

PRINDLE'S

Patent Metallic

Wire Packed

UNIONS.

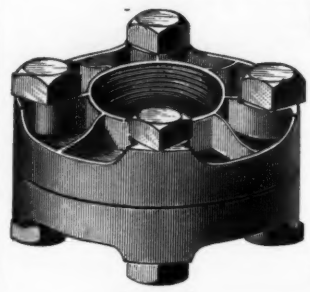


Malleable and Gray Iron Fittings, Wrought Iron Pipe,

BRASS AND IRON BODY GOODS,

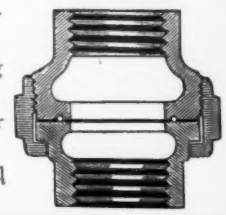
GAS AND STEAM FITTERS' TOOLS AND SUPPLIES.

SEND FOR PRICE LIST.



Patented.

Unexcelled for Hot Water or Steam.
The only Perfect Packing for Natural Gas.
Especially adapted for Car Heating.
Permanently Durable for all Fluids and Liquids.



JAMES P. WITHEROW,

ENGINEER AND CONTRACTOR,

LEWIS BLOCK, PITTSBURGH, PA.,

GENERAL AGENT FOR

Whitwell Fire-Brick Stoves and Clapp-Griffiths Patents

FOR THE MANUFACTURE OF SOFT STEEL.

Specially adapted for A No. 1 Boiler Plates, Boiler Rivets, Wire Rods, Stay Bolts, Stamping Ware, Nail Plates, etc. Will contract to completely erect, equip and place in operation blast furnaces, Whitwell stoves and steel plants as above. As I manufacture at my own works, everything appertaining to blast furnace and steel works construction I can guarantee promptness and satisfaction.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g,

CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and cheapest Paint made.

FURNISHED both Dry and Ground in Oil.

USED BY NEARLY ALL THE RAILROADS.

THIS SPACE IS TAKEN BY

SMITH & SILK,

MANUFACTURERS OF

IRON PLANERS.

26x26 and 28x28, 30x30, with bed from 6 to 14 ft. long. Address all correspondence to

SMITH & SILK,

N. E. Cor. 8th and Lock, CINCINNATI, O.

KINGERY'S

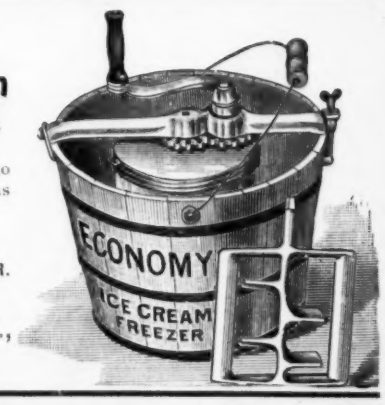
Economy Freezer

Was placed before the public in 1888, and, owing to its cheapness, simplicity, etc., the demand for it has never been equaled by any other Freezer.

SEND FOR PRICES BEFORE ORDERING ANY OTHER.

KINGERY MANUFACTURING CO.,

West Pearl St., Cincinnati, O.



The Kanneberg Roofing Co., Canton, O.,

(The Originators of Strictly Genuine Steel Roofing.)

MANUFACTURERS OF

THE KANNEBERG PATENT

LATEST IMPROVED FOLDED LOCK SEAM

Strictly Genuine Steel Roofing

WRITE FOR CATALOGUE, PRICE

CORRUGATED IRON,

(Four Sizes of Corrugations.)

Crimped Edge Iron Roofing and Siding, Beaded Iron Siding and Ceiling, Water Proof Building Paper, Ready-Mixed Paints, Etc.

LIST AND SAMPLES.

Classified List of Advertisers.

The star * indicates that the adv. appears alternate weeks; the dagger † once a month; the double dagger ‡ irregularly.

PAGE.

Bolts and Nuts—
Hotchkiss & Upson Co., Cleveland 16
Colwell & Collins, Norway Bolt Co., Cleveland 16

Brick and Tile Machines—
Frey, Sheckler & Hoover, Bucyrus, O..... 18
*Stevenson & Co., Wellsville, O. 11

Bicycles and Tricycles—
A. W. Gump & Co., Dayton, O..... 14

Babbitt Metal—
Fay Manufacturing Co., Elyria, O..... 12

Beltings—
Parkin & Bosworth, Cleveland..... 20

Belt Holders—
*W. R. Santley & Co., Wellington, O..... 16

Boilers—
J. C. McNeil & Co., Akron, O..... 16
Mansfield Steam Boiler Works, Mansfield, Ohio..... 16
Reeves Bros., Niles, O.....20 & 16
Sharon Boiler Works, Sharon, Pa..... 20
Enterprise Boiler Co., Youngstown, O..... 14
*John T. Caulfield, Richmond, Ind..... 12
Harmes Machine Depot, Pittsburgh, Pa... 20

Boiler Setting—
Variety Iron Works, Cleveland..... 17

Bevel Jig Mills—
C. J. McNutt, Ashtabula, O..... 19

Burglar Alarms—
Cuyahoga Manufacturing Co., Cleveland.. 14

Coal and Coke—
Pittsburgh & Wheeling Coal Co., Cleveland..... 10

Cranes and Derricks—
Phœnix Iron Works, Cleveland..... 14
McMyler Manufacturing Co., Cleveland..... 14
Wm. Tod & Co., Youngstown, O..... 18

Car Wheels—
Bowler & Co., Cleveland..... 15
Cleveland Wheel & Foundry Works, Cleveland..... 18

Chemical Laboratory—
J. F. Elsom, New Albany, Ind..... 12

Cutters—
†Brown & Sharpe Mfg. Co., Providence, R.I. 20

Damper Regulators—
*Curtis Regulator Co., Boston, Mass..... 19

Drilling Machines—
Bickford Drill Co., Cincinnati, O..... 14
Universal Radial Drill Co., Cincinnati, O.. 16
*E. A. Schumacher, Cincinnati, O..... 14
Huntington & Lunt, Cleveland..... 20

Engineers and Contractors—
E. H. Jones & Co., Cleveland..... 14
Jas. P. Witherow, Pittsburgh, Pa..... 15
Alex. Laughlin & Co., Cleveland..... 14
McClure & Schuler, Pittsburgh, Pa..... 14

Elevators—
L. S. Graves & Co., Rochester, N. Y..... 19

Explosives—
Hercules Powder Co., Cleveland..... 18

Electric Lighting Apparatus—
Brush Electric Co., Cleveland..... 19

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill..... 13

Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland..... 11
Murray & Heiss, Cleveland..... 16

Engines (Steam)
Kilby Manufacturing Co., Cleveland..... 15
Novelty Iron Works, Canton, O..... 16
Aetna Machine Co., Warren, O..... 18
Lloyd & Sterret, Erie, Pa..... 16
Wm. Tod & Co., Youngstown, O..... 18
E. H. Jones & Co., Cleveland..... 14
*Columbus Machine Co., Columbus, O..... 19
*Chandler & Taylor Co., Indianapolis, Ind. 12
Buckeye Engine Co., Salem, O..... 18
Harmes Machine Depot, Pittsburgh, Pa..... 20

Engines (Gas)—
Schleicher, Schumm & Co., Philadelphia, Pa. and Chicago, Ill..... 18

Engineers' Specialties—
Crescent Manufacturing Co., Cleveland... 19
*Curtis Regulator Co., Boston, Mass..... 19
Cleveland Flue Cleaner Co., Cleveland..... 16

Files, Makers of—
Reynolds Bros., Columbus, O..... 20

Forges—
Cleveland City Forge & Iron Co., Cleveland 18

Foundries—
Bowler & Co., Cleveland.....10 & 15
Taylor & Boggis Foundry, Co., Cleveland 16
Wm. Fitzsimmons & Son, Cleveland..... 16
Curry & Co., Meadville, Pa..... 16
Cleveland Wheel & Foundry Works Cleveland..... 18

Flue Cleaners—
Cleveland Flue Cleaner Co., Cleveland 16
Crescent Manufacturing Co., Cleveland..... 16

Feed Water Heaters—
Stilwell & Bierce Manufacturing Co., Dayton, O..... 20
Laidlaw & Dunn Co., Cincinnati, O..... 18
W. C. Armstrong & Co., Springfield, O..... 15
Hoppes Manufacturing Co., Springfield, O. 18
E. H. Jones & Co., Cleveland..... 14

For Sale—
Foundries, Furnaces, Machinery, etc..... 16

Foundry Cupolas—
Victor Colliau, Detroit, Mich..... 14

Frost Proof Steam Traps—
*Curtis Regulator Co., Boston, Mass..... 19

Foundry Supplies—
J. D. Smith & Co., Cincinnati, O..... 19

Hardware—
W. Bingham Hardwar eCo., Cleveland..16 & 20
Eberhard Manufacturing Co., Cleveland... 61

Ice Cream Freezers—
Kingery Mfg. Co., Cincinnati, O..... 15

Injectors—
Columbia Injector Co., Cleveland..... 16

Iron Roofing—
Sykes Iron Roofing Co., Niles, O..... 14
Cambridge Iron Roofing Co., Cambridge, Ohio..... 20
Garry Iron Roofing Co., Cleveland 12
Standard Iron Co., Bridgeport, O..... 14
Cincinnati Corrugating Co., Cincinnati, O. 14
Kanneberg Roofing Co., Canton, O..... 14

Iron Ore and Pig Iron—
Dalliba, Corrigan & Co., Cleveland..... 11
Tuttle, Oglebay & Co., Cleveland..... 11
J. H. Outhwaite & Co., Cleveland..... 11
Pickands, Mather & Co., Cleveland..... 11

Iron Planers—
Smith & Silk, Cincinnati, O..... 15

Key Seating Machines—
W. P. Davis, Rochester, N. Y..... 20

Lumber—
Fisher & Wilson Co., Cleveland..... 15
Martin & Barris, Cleveland..... 16

Lathes—
Muller Machine Co., Cincinnati, O..... 20
Sebastian, May & Co., Cincinnati, O..... 13
H. L. Shepard, Cincinnati, O..... 14

Mining Machinery—
American Manufacturing, Mining & Milling Co., Cleveland..... 18
Webster, Camp & Lane Machine Co., Akron, O..... 12

Machinery—(General)
*Columbus Machine Co., Columbus, O..... 19
Harmes Machine Depot, Pittsburgh, Pa... 20

Machine Shops—
Webster, Camp, & Lane Machine Co., Akron, O..... 16
Novelty Iron Works, Canton, O..... 16

Machinists' Tools and Supplies—
Parkin & Bosworth, Cleveland..... 20
E. E. Garvin & Co., New York..... 14

Natural Gas Stoves—
Schneider & Trenkamp, Cleveland..... 19

Patents—
M. D. & L. L. Leggett, Cleveland..... 19
Osborne & Monroe, Cleveland..... 16
*Thomas P. Simpson, Washington, D. C... 11

Pumps (Steam)—
John H. McGowan & Co., Cincinnati, O..... 14
E. H. Jones & Co., Cleveland..... 14

Pumps (Chain)
S. E. Crawford, Norwalk, O..... 20

Pig and Bar Iron—
Condit, Fuller & Co., Cleveland, O....*..... 11
Cleveland Rolling Mill Co., Cleveland..... 12
Hussey & Pomeroy, Cleveland..... 11

Paint—
Iron Clad Paint Co., Cleveland..... 15

Pipe Coverings—
John A. McConnell & Co., Pittsburgh..... 16

Punching and Shearing Machine—
*Bertch & Co., Cambridge City, Ind..... 12

Railway Supplies—
Bowler & Co., Cleveland..... 15
Cleveland City Forge & Iron Co., Cleveland..... 18
Cleveland Wheel & Foundry Works, Cleveland..... 18

Railroads—
Time Tables, Etc..... 13

Reducing Valves—
*Curtis Regulator Co., Boston, Mass..... 19

Water Columns—
Reliance Gauge Co., Cleveland..... 20

Steam Heating Apparatus—
*Curtis Regulator Co., Boston, Mass..... 19
A. A. Griffing Iron Co., Jersey City, N. J... 15

Stoves—
Taplin, Rice & Co., Akron, O..... 16

Steam Boiler Inspectors—
Hartrord Steam Boiler Inspection & Insurance Co., Hartford, Conn..... 14

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland..... 11
W. F. Thornton, Cleveland..... 11

Saws—
E. C. Atkins & Co., Indianapolis, Ind..... 20

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland..... 16

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland..... 12

Sheet Steel—
Standard Iron Co., Bridgeport, O..... 14

Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa..... 19

Steam Fitters' Supplies—
Worswick Manufacturing Co., Cleveland.. 15

Stampers of Sheet Metal—
Avery Stamping Co., Cleveland..... 18

Spooled Wire—
Malin & Co., Cleveland..... 14

Twist Drills—
Cleveland Twist Drill Co., Cleveland..... 20

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland..... 18

Wire Goods—
F. Powell & Co., Toledo, O..... 20
‡Sedgwick Bros., Richmond, Ind..... 13

Wire Machinery—
John Adt & Son, New Haven, Conn..... 18

For Sale.

ONE OF DUNN'S HOISTING MACHINES, with over 40 feet of chain. Good as new; capacity, 600 lbs. Address Dunn, care Iron Trade Review, Cleveland, O.

For Sale Cheap.

A NEW NO. 4 INJECTOR, never been used. Address Jones, care Iron Trade Review, Cleveland, O.

For Sale and Wanted.

TEE RAILS of every size of iron and steel, new and second hand. J. JEWKES, Iron Broker, Pittsburgh, Pa.

For Sale.

TIMBER LANDS in Arkansas, West Virginia, Kentucky, Tennessee, North Carolina and other Southern States. Also in Oregon and Washington. Parties seeking investments in timber land or other real estate, will please enclose two-cent stamp for our latest pamphlet, describing lands and location. Address Western Promoting & Developing Company, Chillicothe, Ohio.

Wanted.

GOOD SECOND HAND ENGINES, Boilers, and other Machinery, Plates and Castings, suitable for use in a Rolling Mill. Give dimensions, conditions, etc., in detail, with bottom prices on cars for cash. Address P. O. Box 323, Cincinnati, O.

Engineers' Specialties. The Crescent Lubricating Compound and Automatic Grease Cups will effect a saving of 75 per cent. over oil. Investigate their merits. **CRESCENT MFG. CO., Cleveland, O.**

Engineers Don't be Deceived. The Cyclone Steam Flue Cleaner is the only Cleaner made giving steam a spiral motion the entire length of the tubes.
CRESCENT MFG CO., Cleveland, O.

ENGINEERS! DON'T BE HUMBUGGED. We guarantee our A. & D. Flue Cleaners to give Steam the most perfect spiral motion entire length of tubes, and do the best work.
Cleveland Flue Cleaner Mfg. Co.,
74 Frankfort St., Cleveland, O.

JOHN A. McCONNELL & CO., PITTSBURGH, PA.

PIPE Coverings,

Hot Blast Abestos Cement, Mineral Wool and Hair-Felt Coverings of every description. The above cut shows **REED'S CELEBRATED SECTIONAL COVERING.**

AUTOMATIC

VERTICAL ENGINES.

Especially designed for

Small Electric Light Plants.

Perfect Regulation. 5 to 20 Horse-Power.

Send for Specifications and Prices.

LLOYD & STERRETT,

ERIE, PA., U. S. A.

☞ Mention this paper.

E. A. SCHUMACHER, MANUFACTURER OF
Upright - Drills,
28-30 WEBSTER ST., CINCINNATI, O.
S. M. York, Agent for Cleveland, O.

Joseph A. Osborne, William M. Monroe, Of the U. S. Supreme Ct. Bar. Patent Expert.

Osborne & Monroe,

PATENTS

29 EUCLID AVE., CLEVELAND, O.

Patent Causes litigated in the United States Supreme and Circuit Courts. **UNITED STATES AND FOREIGN PATENTS PROCURED.** Searches and Opinions as to the Scope, Validity and Infringement of patents. Terms Reasonable.

CLEVELAND BUSINESS DIRECTORY.

Bolt and Nut Works.

THE HOTCHKISS & UPSON CO., Manuf'rs. Machine, Plow and Elevator Bolts, Coach Screws.

Carriage Bolts.

THE COLWELL & COLLINS NORWAY BOLT CO., manufacturers of Philadelphia Carriage and Tire Bolts.

Coal, Iron and Ore.

PICKANDS, MATHER & CO., Iron Ore and Pig Iron, Cor. Bank and Superior Sts.

Foundries.

BOWLER & CO., Car Wheels, Patent Chilled Frogs, and all kinds of casting. 9 Winter.

TAYLOR & BOGGIS FOUNDRY CO. Fine Gray Iron Castings. 65 to 73 Central Way.

Hardware and Iron.

BINGHAM, WM. & CO., Hardware, Iron, Nails and Metals, 148 and 150 Water St.

CLEVELAND ROLLING MILL CO., manufacturers of Steel and Iron Wire and Steel Tire.

THE EBERHARD MF'G CO., manfrs. of Carriage, Wagon and Saddlery Hardware.

Hardwood Lumber.

MARTIN & BARRISS, dealers in all kinds of Hardwood Lumber. 130 Central Way.

Lumber.

FISHER, WILSON & CO., Wholesale lumber dealers (pine and hardwood), rough and dressed lumber, timber, lath, shingles, etc. 47 Central way.

Machinists' Supplies.

PARKIN & BOSWORTH, 9 and 11 So. Water St., dealers in Manufacturers' Supplies, Machinery and Tools.

Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils. 92 Seneca St.

BUSINESS DIRECTORY.

Akron, O.

MCNEIL, J. C. CO., Steam Boilers, Heavy Sheet Iron Work, &c. Repairing promptly executed.

TAPLIN, RICE & CO., manuf'rs of Stoves and Hollow Ware, dealers in Tinners' Stock, etc.

WEBSTER, CAMP & LANE MACHINE CO., Founders and Machinists, 12 Main st.

Canton, O.

NOVELTY IRON WORKS, Mill Work, Shafting, Engines, Imperial job printing press, etc.

Meadville, Pa.

CURRY & CO., general jobbers in Castings of all kinds.

Mansfield, O.

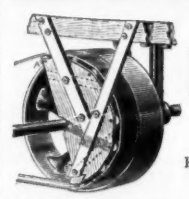
MANSFIELD STEAM BOILER WORKS, Manf'rs of Steam Boilers, Oil and Water Tanks, and all kinds of Sheet Iron Work.

Niles, O.

REEVES BROS., Manufacturers of Boiler, Tank and Sheet Iron Work, etc.

Toledo, O.

NORTH WESTERN SAW WORKS. Manufacturer and dealer in Saws and Planer Knives. Moulding Bits of every description made to order. No. 8 South St. Clair St.



WELLINGTON Belt Holder.
Recently Improved.

BETTER THAN LOOSE PULLEYS.

Shifts Belt from Driving Pulley.

Belt stops when machine stops and lies slack until machine starts. Simple, cheap, easily operated. Sent on approval. Thousands in use. Address

W. R. SANTLEY & CO.,
Wellington, O.

Steam Jet Pumps,	-	**From $4.00 up.**
Automatic Injectors,	-	**" $5.00 up.**
High Lifting Injectors,		**" $6.00 up.**
Shafting, Hangers,	- -	**" $1.00 up.**

COUPLINGS, BOXES, COLLARS, ETC.
Write for Circulars, Etc.

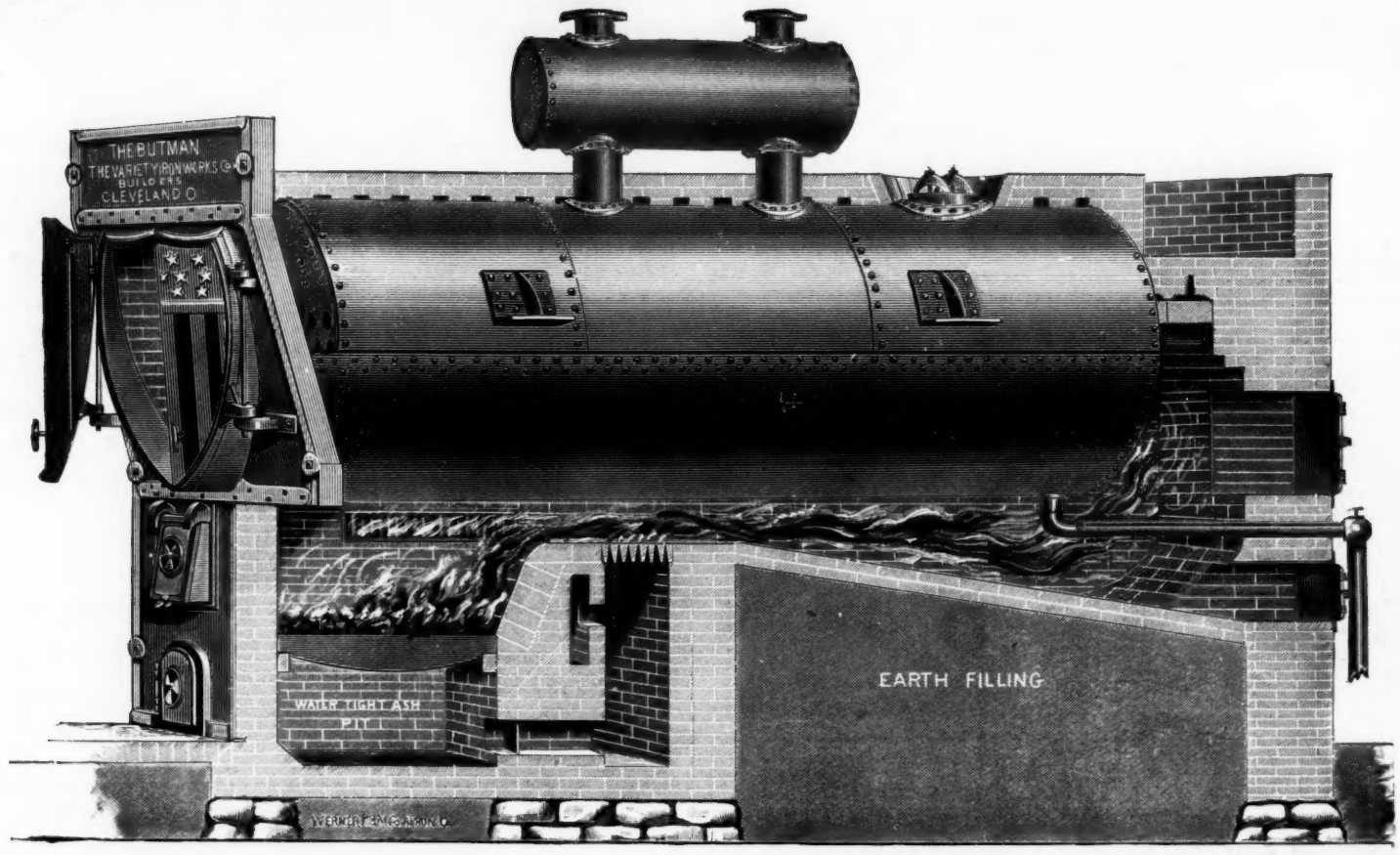
COLUMBIA INJECTOR CO., CLEVELAND, O.

THE

JARVIS ENGINEERING CO.'S

PATENT SYSTEM OF

SETTING STEAM BOILERS.



Boiler Setting.

HOW TO REDUCE THE EXPENSE OF GENERATING STEAM.

The Jarvis Patent in Operation, and What it Proves.

To all users of steam the question of reducing the cost of generating the amount of steam required is an important one, and steam users are accordingly on a constant lookout for the most economical method of boiler setting. In a recent issue of the Canton "Repository," a detailed report is published of setting of new boilers at the Diebold Safe & Lock Works which will explain what is claimed to be the most economical system practicable. It is the Jarvis Patent System, an illustration of which is given in the above cut. The plan is a vast improvement over any in use, and many advantages are claimed for it. In explanation of the Jarvis system as applied in that city, the "Repository" says:—

New boilers are being set up at the Diebold Safe & Lock Works, under a greatly improved plan. It is the Jarvis Patent System of setting steam boilers, and the work is being done by the furnace department of the Variety Iron Works Company, of Cleveland. By this system, which is attracting much attention, the manner of setting up steam boilers, a matter of considerable importance to manufacturers and others, is being revolutionized, and a description of it may not be out of place.

To begin with, the principal features in this furnace consist in the setting, whereby air is admitted by small flues in the front, and then conducted through a number of horizontal expanding ducts, in which it traverses backward and forward, until it finally, and in a heated state, enters by the furnace bridge wall and other places, uniting with the products of combustion and causing consumption of the gases, which would ordinarily pass off unconsumed and wasted.

The air, heated in its transit through the expanded passages, is discharged in jets through fire-brick plates on the sides of the furnaces, and also at the bridge wall, and when it comes in contact with the gases immediately bursts into flame with intense heat, resulting in large economy of fuel consumed and also increasing capacity. This surface fire, as it may be called, enables consumers to use, as fuel, many kinds of waste and refuse that would virtually put out an ordinary fire, for it is evident that sufficient air cannot pass through the bed of coal dust or other fine fuels on the grate to produce anything like good combustion; in fact, the fuel on the grate is really, and may be called a "gas producer," and the Jarvis furnace, like the Siemens, has a continuous supply of hot air to utilize that gas.

In accurate tests, made at the Edison Laboratory, Menlo Park, N. J., where a 75 H. P. boiler was worked at its normal rating, the temperature ranged from 600 to 650 degrees before being distributed through the perforated plates, and as these plates are just above the fire, the temperature of the air must have been greatly increased before joining with the gases.

Anyone who will take the trouble to watch the operation of the furnace, especially in using soft coals, must notice the much whiter color of the flame upon the hot air joining it—changing from a dull red to a dazzling white—and any iron worker will testify that the whiter the flame the more intense the heat. This is a point on which, as all must admit, the Jarvis system gives the economy, and the practical results fully bear it out. The economy obtained is much larger if parties will derive the full benefit to be obtained from the cheap fuels which, as clearly shown, can be utilized by the Jarvis system. Every steam user or producer should make it a duty to see what cheap fuel can be procured in his vicinity, and by the adoption of the Jarvis furnace reduce the expense of generating the required steam.

Many manufacturers can obtain sawdust, tan or other refuse near their works, and every such opportunity should be availed of.

This furnace has won favor in every instance where it has been in operation. In this city it may be seen in working order, among other places, at the County Buildings, the Cleveland Rubber Company's plant, and on waste fuel, such as shavings and sawdust, it is in operation at Woods, Jenks & Co.'s planing mills.

THE VARIETY IRON WORKS CO.

OHIO AGENTS FOR THE JARVIS SYSTEM OF BOILER SETTING.

THE AMERICAN

MANUFACTURING, MINING & MILLING CO.,

MANUFACTURERS OF ALL KINDS OF GOLD AND SILVER

MINING

MACHINERY,

Cleveland, O.

SPECIALTIES.—The Linn Double-Jaw Rock Breaker and Ore Crusher; The Standard Pulverizer (for wet pulverizing); The Crescent Pulverizer (for either wet or dry pulverizing) Howland's Rapid Amalgamator; Secor's Improved Amalgamating Pan (for treatment of refractory ores); Howland's Improved Disintegrating and Concentrating Rifles.

AGENTS WANTED. CORRESPONDENCE SOLICITED. CATALOGUES SENT ON APPLICATION.

Cleveland Wheel & Foundry Works,

MAHER & BRAYTON, Propr's,

MANUFACTURERS OF

Car, Engine, Truck and Tender Wheels.

RAILROAD, ROLLING MILL AND MACHINERY CASTINGS,

—AND—

Street Railroad Wheels and Turnouts.

Also Chilled-Faced Railroad Frogs.

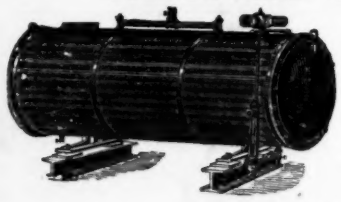
OFFICE: 20 CARTER ST.,

Works: Cor. Carter and Collins Streets,

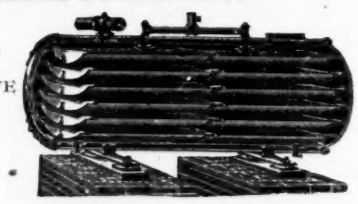
Cleveland, O.

THE HOPPES FEED-WATER PURIFIER.

SOLD ON TRIAL. CLEAN BOILERS GUARANTEED.



SEND FOR DESCRIPTIVE CIRCULAR A

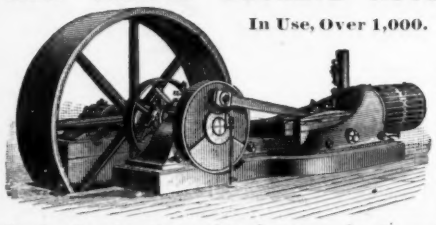


Hard Sheet Steel Troughs Easily Cleaned.

HOPPES MANUFACTURING CO., Springfield, Ohio.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. **25 to 1,000 H. P.**



These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained automatic Cut-off Engines 12 to 100 H. P. for driving Dynamo Machines a specialty. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. Address

BUCKEYE ENGINE CO., Salem, O.

SALES AGENTS: W. L. SIMPSON, 301 Telephone Building, 18 Courtlandt Street, N. Y.; N. W. ROBINSON, 154 Washington Street, Chicago, Ill.; ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, Limited, Philadelphia,

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

"SPECIAL STAMPERS OF SHEET METALS."

We do Stamping and Pressing of Sheet Metals for all Classes of Work.

ALSO SOLE MANUFACTURERS OF

Seamless Steel Buckets.

Ask your dealer for the Avery Patent Seamless Steel Elev. Bucket.

THE AVERY STAMPING CO.,

Successors to The Avery Elevator Bucket Co.,

Cleveland, O., U. S. A.

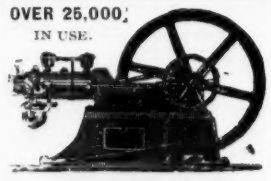
Otto Gas Engine Works,

SCHLEICHER, SCHUMM & CO., Philadelphia. Chicago.

Horizontal **OTTO** Gas Engines.
Vertical **OTTO** Gas Engines.
Twin Cylinder **OTTO** Gas Engines.
Combined **OTTO** Gas Engine Pumps.
Combined **OTTO** Gas Engine Dynamos.

SIZES: 1, 2, 4, 7, 10, 15, 25 AND 50 HORSE-POWER.

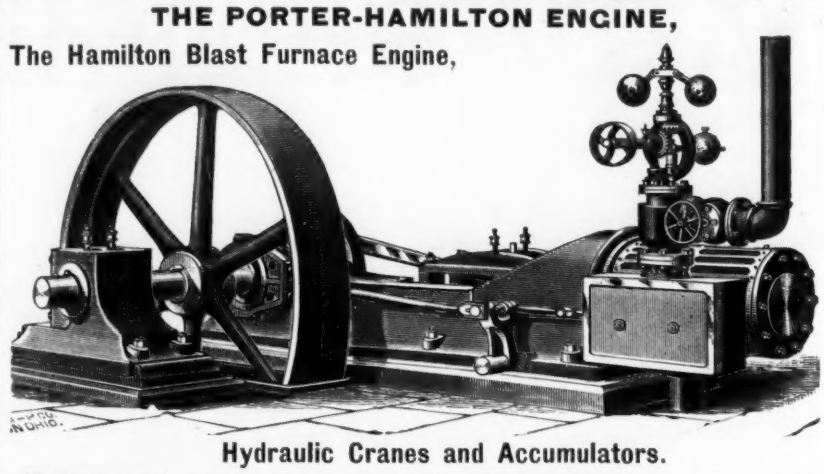
OVER 25,000 IN USE.



WILLIAM TOD & CO., Youngstown, O.

THE PORTER-HAMILTON ENGINE,

The Hamilton Blast Furnace Engine,



Hydraulic Cranes and Accumulators.

Heavy special machinery generally. Send for illustrated catalogue.

HERCULES POWDER

HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE Known to the Arts.

POWDER, FUSE, CAPS, Electric Mining Goods,

AND ALL TOOLS FOR STUMP BLASTING,
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
J. W. WILLARD, Manager.

THE ÆTNA MACHINE COMPANY,

SOLE MANUFACTURERS OF THE

Aetna Medium and High Speed Engines.

300 to 1000 Horse Power. Latest Design.

For Rolling Mills, Furnaces, Pipe Works, Grist and Saw Mills, Etc. Also Manufacturers of

Upright Engines from 10 to 150 H. P.

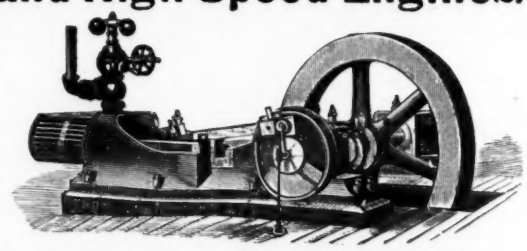
Rolling Mill and Special Machinery, Light and Heavy Castings, and

M. V. SMITH'S

Gas Producer and Furnace.

ENGINES ALWAYS IN STOCK.

Warren, · Ohio.

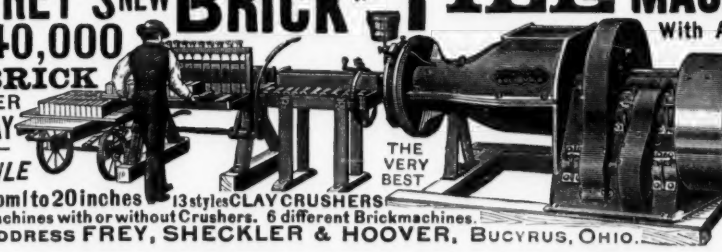


FREY'S NEW BRICK AND TILE MACHINE

40,000 BRICK PER DAY

TILE from 1 to 20 inches

With Automatic CUT OFF.



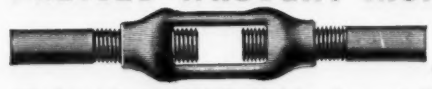
13 styles CLAY CRUSHERS

Machines with or without Crushers. 6 different Brickmachines.

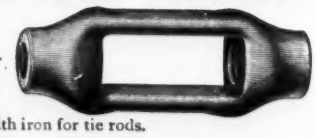
Engines and full Factory OUTFITS

ADDRESS FREY, SHECKLER & HOOVER, BUCYRUS, OHIO.

PRESSED WROUGHT IRON OPEN TURN BUCKLES.



BEST AND CHEAPEST.



The list retail price of this Buckle is less than one-half the wholesale price of inferior goods when we commenced to manufacture, and dealers, even in small towns, find it profitable to carry a stock to sell with iron for tie rods.

CLEVELAND CITY FORGE & IRON CO., CLEVELAND, OHIO.

JOHN ADT & SON,

NEW HAVEN, CONN.

Builders of

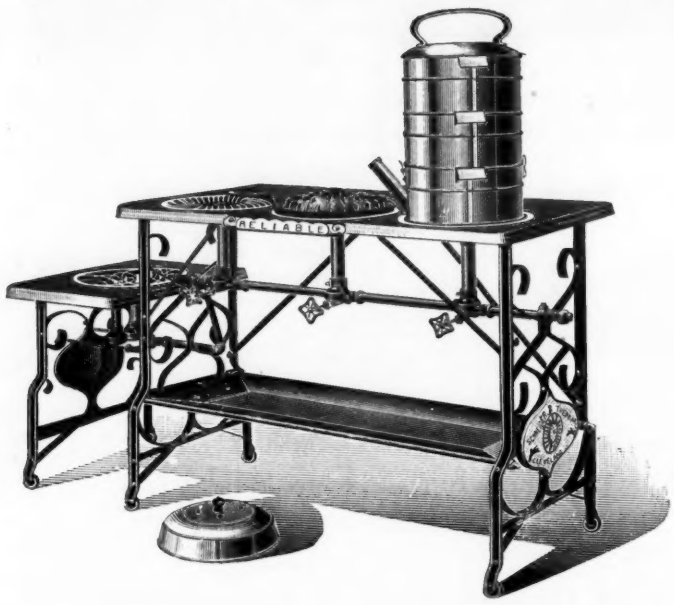
Machinery for Straightening and Cutting Wire to Accurate Lengths DIRECT FROM THE COIL.

Also, Machinery for Hardware and Other Manufacturing.

COME SLOWER OR QUICKER, IT IS SURELY COMING!

THE VERDICT OF THE PEOPLE IN THE

NATURAL GAS BELT



THAT THE RELIABLE 1889

NATURAL GAS STOVES

LEAD THE WORLD.

PERFECT COMBUSTION OBTAINED.

NO SMOKE OR SMELL.

As a Summer Stove it is Unexcelled.

The Reliable Artificial Gas Stoves and Gasoline Stoves are the Best.

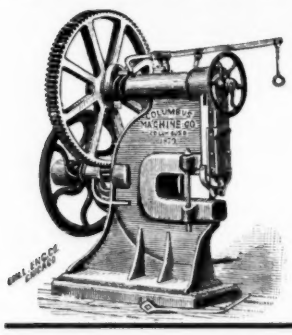
Sample Stoves Sent to Responsible Dealers.

☞ SEND FOR CATALOGUE.

THE SCHNEIDER & TRENKAMP CO.,

CLEVELAND, OHIO.

COLUMBUS MACHINE CO., COLUMBUS, OHIO,



—— MANUFACTURERS OF ——

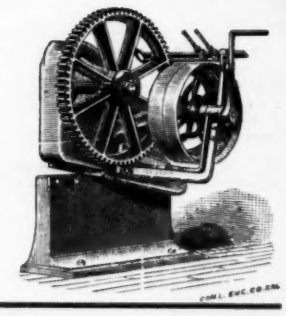
Blast Furnace, Stationary, Portable and Hoist Steam Engines,

Boilers of all descriptions; Rolling Mills; Drop Presses; Shears for Rail, Bar and Plate Rolling Mills; Punches and Shears—Single and Combined; Boiler and Sheet Iron Rolls—Hand or Power; Boiler Makers' Shears and Punches; Shafting; Couplings; Hangers and Pulleys.

Blowing Engines, and Blast Furnace Work in all Its Branches a Specialty.

ALSO HEAVY CASTINGS AND MACHINERY WORK.

☞ **Blast Furnace Engines on Hand.**



G. W. STOCKLY, President. J. J. TRACY, Vice-President. W. F. SWIFT, Secretary.
J. POTTER, Treasurer. N. S. POSSONS, Supt. W. J. POSSONS, Asst. Supt.
S. M. HAMILL, JR., Assistant Secretary.

THE BRUSH ELECTRIC CO.,

Sole Manufacturers under all the

PATENTS OF CHARLES F. BRUSH, FOR ELECTRIC LIGHTING, STORAGE BATTERIES, CARBONS, ELECTRO-PLATING MACHINES, ELECTRO MOTORS, ETC.

The Brush Light Still Leads the Field.

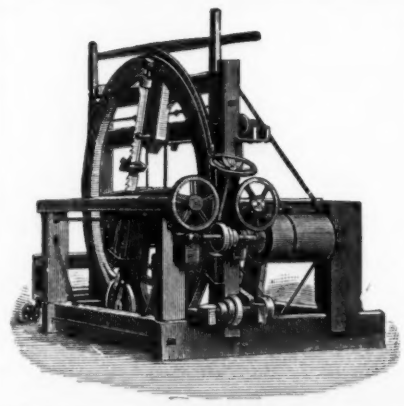
No other System in the World equals ours in Simplicity, Durability, Earning Capacity, Reliability. The Best is always the Cheapest.
45,000 Brush Arc Lamps now in use. Self-Regulating Incandescent Apparatus.

GET OUR AGENT TO MAKE PLANS FOR YOU BEFORE BUYING ELSEWHERE.

THE BRUSH ELECTRIC CO.,

CLEVELAND, OHIO, U. S. A.

☞ Agencies Everywhere.



C. J. McNUTT, Ashtabula, O.,

MANUFACTURER OF

BEVEL JIG MILLS,

FOR SHIP BUILDERS.

The Best and Cheapest Mill on the Market.

NO SHIP YARD SHOULD BE WITHOUT THIS MACHINE.

☞ SEND FOR PRICE LIST AND CIRCULAR.

STEEL CASTINGS

FROM ¼ TO 15,000 Lbs. WEIGHT,

TRUE TO PATTERN, sound, solid, free from blow-holes, and of unequalled strength. Stronger and more durable than iron forgings in any position, or for any service whatever. 4,000 Crank Shafts and 3,000 Gear Wheels of this steel now running prove this. Cross-heads, Rockers, Piston Heads, etc., for Locomotives. STEEL CASTINGS of every description. Send for circulars and prices to

Chester Steel Casting Co.,

WORKS: CHESTER, PA. | OFFICE: 407 LIBRARY ST., PHILADELPHIA, PA.

FREIGHT AND PASSENGER

ELEVATORS.

L. S. GRAVES & SON,

Corner Center and Frank Streets, Rochester, N. Y.

New York Office, 46 Cortland St.; Cleveland Office, 208 Superior St.

SEND FOR OUR CATALOGUE.

E. C. ATKINS & CO.

INDIANAPOLIS, IND. and MEMPHIS, TENN.

MANUFACTURERS OF

CROSS-CUT, CIRCULAR, BAND AND GANG SAWS

FINE SAWS A SPECIALTY.

SOLE MANUFACTURERS OF THE FOLLOWING BRANDS CROSS-CUT SAWS:

Silver Steel Diamond, Concave Tooth Dexter, Special Steel Diamond, Original Tuttle Tooth Improved, Extra Quality One-Man and Narrow Cross-Cut Saws.

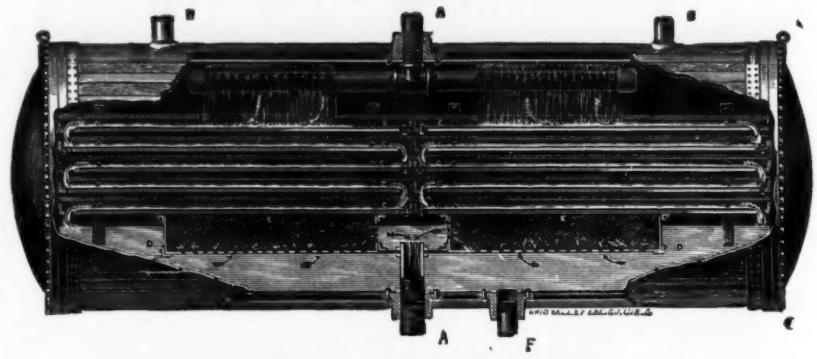
ALL LUMBERMEN REQUIRE CROSS-CUT SAWS.

USE ONLY THE BEST.

Our CROSS-CUTS are acknowledged as "Incomparably the best in use," and are. We are Agents for **Tanite Emery Wheels and Grinding Machinery.**

NEW FEED WATER PURIFIER AND FILTER.

USES LIVE STEAM.

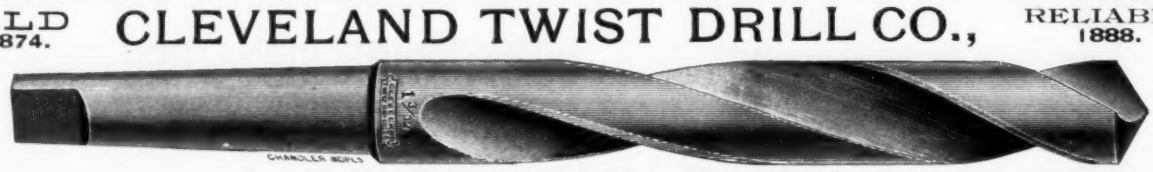


Illustrated Catalogue Free.

STILWELL & BIERCE MANUFACTURING CO.

DAYTON, OHIO.

OLD 1874. CLEVELAND TWIST DRILL CO., RELIABLE 1888.



SEND FOR CATALOGUE. Cor. Lake & Kirtland Sts., Cleveland, O. WRITE FOR DISCOUNTS.

SAFETY is not the only advantage offered by the

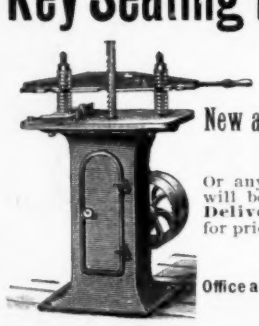
RELIANCE SAFETY Water Columns.

They enforce Economy of Fuel and Repairs by causing the water to be kept at the proper height. Sold subject to satisfaction. Send for illustrated price list.

Reliance Gauge Co.,

827 Sheriff St., Cleveland, O.

Key Seating Machines and 20-inch Drills



A SPECIALTY.

Send for List of

New and Second-Hand Lathes, Planers, Drills, ENGINES AND BOILERS,

Or anything in Machinists' Tools or Supplies. We will be pleased to quote prices on **Machinery Delivered** in any part of the United States. Write for prices and catalogue to

W. P. Davis,

Office and Salesroom, 169-171 Mill St., Rochester, N. Y.

WORKS AT NORTH BLOOMFIELD, N. Y.

SHULTZ RAW HIDE BELTING.

Furnished Single, Double and Light-Double Pegged, Sewed, Rivetted or Cemented only. Guaranteed superior to the best grades of oak-tanned. Stretches less and will transmit more power.

Parkin & Bosworth, 9 AND 11 SOUTH WATER ST., CLEVELAND, O.

Huntington & Lunt,

MANUFACTURERS OF

Quick Return Drill Presses,

SPEED LATHES AND CRAB WINCHES.

Send for Circular and Price List.

13 CHAMPLAIN STREET

CLEVELAND - - OHIO.

THE STANDARD TOOL CO.,

CLEVELAND, OHIO,

MANUFACTURERS OF

Increase Twist Drills, Etc., Taper Shank Drills,

Straight Shank Drills, Machine Bit Drills, Screw Driver Bits, Bit Stock,

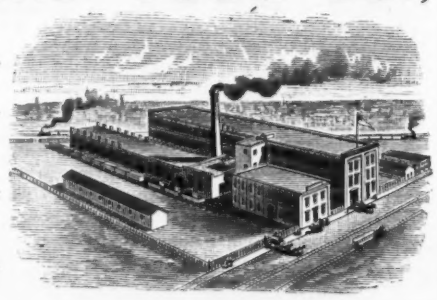
SOCKETS, HAND AND SHELL REAMERS, STANDARD GAUGES,

Milling Cutters and Special Tools, Morse Taper Reamers.

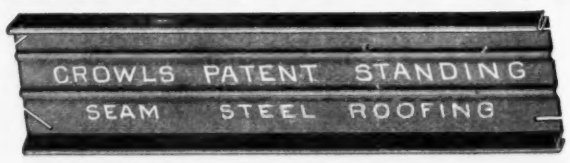
STANDARD PATENT

TWIST DRILL GRINDING MACHINE.

New York Office 33 Chambers Street.



CAMBRIDGE ROOFING CO., Cambridge, O.,



Manufacturers of

Plain, Rolled, Crimped Edge, Corrugated and Beaded Roofing, Siding and Ceiling.

PURE STEEL A SPECIALTY.

Send for Descriptive Catalogue

THE W. BINGHAM HARDWARE CO.,

146, 148 AND 150 WATER STREET,

CLEVELAND, OHIO.

HARDWARE, IRON, NAILS AND METALS

OF EVERY DESCRIPTION.

Railway, Machinists' and Miners' Supplies.

WILLIAM JESSOP & SONS AND PETER STUBS' CELEBRATED CAST STEEL.

MALLEABLE AND CAST GAS AND WATER FITTINGS.

Nathan & Dreyfus' Self-Acting Oilers and Lubricators, Injectors and Ejectors; Pennsylvania Tube Works Pipe and Boiler Flues; Peet's Open Way Valves; Boston Belting Co.'s Rubber Belting, Packing and Hose; Alexander Bros.'s Leather Belts.

STUBS, GROBET & ROTHERY FILES, ETC., ETC.

NILES BOILER WORKS,

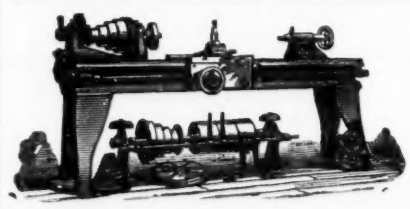
MANUFACTURERS

STEAM BOILERS,

Blast Furnaces, Tanks, Stacks, Stills, Agitators, Car Tanks, Etc.,

REEVES BROS., Props.,

Correspondence solicited. NILES, Trumbull County, O.



NEW AND IMPROVED

17-Inch Engine Lathes.

Any length of bed. Workmanship strictly first-class.

The Muller Machine Tool Co.,

8TH AND EVANS STS., CINCINNATI, O.

The Harmes Machine Depot,

97 AND 99 FIRST AVE., PITTSBURGH.

Steam Engines, Boilers and Machinery,

AUTOMATIC CORLISS AND PLAIN ENGINES,

Vertical and Horizontal, Portable and Stationary, in every size and style, and suited to every purpose where steam power is required.

MACHINERY FOR WORKING WOOD. **MILL GEARING SUPPLIES, ETC.**

REYNOLDS BROS.,

MANUFACTURERS OF

Hand Cut Files

AND RASPS.

We solicit the commercial trade only.

133 & 135 N. Water St.,

COLUMBUS, OHIO.

Old Files Recut and Warranted Superior to any Machine Cut and Lead Tempered in the market. Send for price list.

Champion Rubber Bucket CHAIN PUMP.

Manufactured by **S. E. Crawford,** NORWALK, O.

Chain Pump Pipe Buckets, Common & Expansion, Wood Force Pumps; also dealer in Steel Chain-best quality. Special inducements to parties ordering car lots. **Correspondence Solicited.**

TOLEDO WIRE WORKS.

F. Powell & Co.,

MANUFACTURERS OF

COAL SCREENS,

Wire Bank Railings, Plant Stands, Fire-Proof Lathing, &c.

SUMMIT STREET, **TOLEDO, OHIO.**